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XVIII.—THE ECONOMIC ASPECTS OF THE OIL PALM.

(*Elaeis guineensis*, Jacq.)

An account of the different varieties of the Oil Palm in West Africa has appeared in a previous number of the Bulletin (*K.B.* No. 2, 1909, pp. 33–49), where an attempt has been made to systematise the information obtained from various sources. In the present article it is proposed to deal with questions relating to the habitat, cultivation, yield, &c., of the Palm, the mode of preparation of the oil and other kindred matters.

The information has been derived mainly from the reports received from West Africa in reply to the letter written by the Director of Kew to the Under Secretary of State for the Colonies in February, 1908 (*K.B.*, No. 2, 1909, pp. 33, 34).

Several important papers on the Oil Palm, of which a list is given, have appeared in foreign periodicals and from them, also, extracts have been made.

The following reports from British West Africa have been sent to the Secretary of State for the Colonies and have been forwarded by his courtesy to the Director of Kew :—

(1) The Governor of Southern Nigeria, enclosing reports from Mr. P. Hitchens, Provincial Forestry Officer, Eastern Province ; from Mr. C. A. Birtwistle, Commercial Intelligence Officer, and from Mr. N. C. McLeod, Acting Conservator of Forests ; (2) The Governor of the Gold Coast, enclosing two reports from Mr. A. E. Evans, Travelling Instructor of Agriculture ; (3) The Acting Governor of Sierra Leone (Mr. G. B. Haddon Smith) ; (4) The Governor of the Gambia, with an enclosure from Mr. G. H. Sangster, Commissioner of the Kommbo and Fogni Province ; and (5) the Governor of Northern Nigeria, enclosing a brief report from Mr. B. E. B. Shaw, Forestry Officer.

In addition to the information taken from these reports, extracts have also been made from the 'Notes on the Oil Palm' by Mr. H. N. Thompson, Conservator of Forests, Southern Nigeria,

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published as a supplement to the Government Gazette, Southern Nigeria, No. 10, 1908, and from the articles by M. J. Adam in the French Colonial Bulletin for 1908.

The name of the authority quoted is placed at the end of each extract in the following pages.

Of the nine questions embodied in the Director's letter to the Colonial Office only two were considered in the previous article. In the following pages answers are supplied to the questions as to the habitat of the Oil Palm and the conditions most favourable to its successful growth; as to the yield, commencement of bearing and longevity of the trees; as to the abundance of Oil Palm kernels and of the relation of the supply to the means of communication; and as to whether there has been any improvement in the mode of extracting the oil.

Some other questions relating to the Oil Palm industry are also discussed.

Habitat of the Oil Palm.

The Oil Palm is found on the coast of West Africa from the Gambia (13° N. lat.) as far south as the neighbourhood of S. Paul de Loanda, Angola (9°–10° S. lat.). In the north a few plants have been found in the region of Niayes (about 16° N. lat.) between Dakar and St. Louis. The Palm appears to flourish more particularly along the northern side of the Gulf of Guinea from Sierra Leone to the Cameroons.

It grows to the greatest advantage in the deep, alluvial, humus-covered soil of the forest region which forms a belt of country from 1–300 kilometres in width from Sierra Leone to the Cameroons. Behind this region on the higher land the Oil Palm is still to be found, but this inland zone is not so dense as that of the low lying country and diminishes in importance as it recedes from the coast.

The degree of moisture in the soil is of some importance for the successful growth of the Oil Palm. Where the rainfall is below 50 inches the Palm does not thrive, but it seems to grow equally well in places where the rainfall ranges between 70 and 250 inches; it grows best, however, on well-drained land and will not thrive in swampy land (McLeod). According to Evans it will thrive in almost any soil or situation, but it does not pay to gather the nuts from trees which are growing in the semi-open country near the coast as the yield of oil is exceedingly small. It succeeds best in rich, moist, well-drained land where the rainfall is from 50–70 inches per annum.

It is widely distributed throughout the Gold Coast, but is found in greatest abundance in the Eastern and Central Province.

In Southern Nigeria about three-fourths of the whole region afford suitable conditions of moisture &c. for the growth of the Oil Palm. In Sierra Leone where the country is undulating "the Palms are found to grow both on or close to a swamp where there is always moisture in the soil, and also on a well-drained hill-side where there can be but little moisture in the dry season" (Haddon Smith). It is intended to carry out some comparative examinations of the yield and quality of the fruit of Palms growing in moist and dry situations in Sierra Leone. "In the Gambia the Palm trees are

always to be found in damp places along the banks of streams and in the grass fields which are under water during the rainy season" (Sangster). In Dahomey the plants do not grow on the shallow granitic and gneissic soils in the north, but the rich alluvial soil near the coast is covered with an almost continuous belt of Palms (Adam).

The following account of the Oil Palm in Southern Nigeria is taken from Mr. Thompson's "Notes":—

"The typical species of the Oil Palm appears to be confined, within the limits of Southern Nigeria, to the moist belts of country. It is most plentiful in the native farms and evergreen forests of the Niger Delta, and some of the littoral districts of the Eastern Province, where a heavy annual rainfall is experienced.

"In the hinterland, where the rainfall is deficient, it follows the evergreen belts of forest skirting the larger streams. A dry climate and poor soils do not suit the plant; it is conspicuously absent from the impoverished, grass-covered soils of the hinterland, on which the Fan Palm, *Borassus flabellifer*, and the wild Date Palm, *Phoenix reclinata*, which are so frequently met with, are subject to inundations during the rainy season, and forest fires during the dry period of the year.

"The Oil Palm flourishes best on the rich alluvial humus-covered soils of the forest region. It will also grow on rocky soils, provided there is a sufficient rainfall to bring about a weathering and disintegration of the surface layers of rock.

"Its absence from large tracts of country in the hinterland is most probably due to the annual impoverishment of the soil from exposure to the sun and forest fires, and also to the reduction (during the dry season) of the moisture held by the soil as well as in a few cases to an annual deficiency in the annual rainfall itself.

"Along the dry, sandy shores of the Lagos and Badagry lagoons this partiality of the plant for the richer soils can be easily traced. On the dunes nearest to the sea and lagoons the only palms to be met with are the Fan Palm; a little farther back, where scrubby vegetation has had sufficient time to establish itself and take possession of the soil, and a certain amount of leaf mould exists in consequence, a few very tall, thin, lanky individuals of the typical Oil Palm make their appearance, in company with well-grown examples of the variety of Oil Palm known to the Yorubas as the King Palm, or Ope-Ifa. In this, the habitat *par excellence* of the latter, the growth of the typical species is poor in the extreme, and it is only well back from the shores, where vegetation has had time enough thoroughly to clothe the old sand dunes, enrich the soil, and increase the amount of moisture retained by it, that the type species is at its best.

"The rainfall of the localities referred to is practically the same along the shores of the lagoons as it is three or four miles farther back, where the ordinary variety of the Oil Palm grows so luxuriantly. The real factors that here determine the vigorous growth of the Oil Palm are the increased richness of the soil, due to the presence of decaying organic substances derived from the vegetation growing on it, and the simultaneous increase in the amount of water held in suspension by the soil.

"These considerations explain the absence of the plant from the dry, open districts of the hinterland, where, owing to the destruction of the forests for farming, and the prevalence of 'bush fires,' the organic matter in the soil has been reduced in quantity, and the regulation of the supply of moisture in it has been so disturbed that at one time of the year there is often too much, and at other times too little of it to suit the majority of plants. The actual amount of rainfall in these districts is frequently quite sufficient to ensure luxuriant vegetation if a larger percentage of the rain-water could be held in suspension by the soil during the rains, as is the case with forest-covered soils" (Thompson).

From the foregoing extract it seems clear that a large tract of country in Southern Nigeria is suitable for the growing of Oil Palms should the state of the market demand a larger supply. Thompson proceeds to remark that—"in any efforts that may be made to re-establish this Oil Palm in the open country to be traversed by the Osogbo-Ilorin extension of the railway, the first thing to do will be to protect the area from the annual fires, and allow the forest to grow up again. When the latter is firmly established, the planting up of the land with the Oil Palm can be undertaken with some prospect of success. Re-afforestation can, of course, be hastened by planting up the area with quick-growing trees, shrubs, &c.; but fire-protection is the essential factor in any such scheme, and will have to be rigorously enforced."

M. Adam in summarising the information he has collected on the habitat of the Oil Palm (Adam, l.c. No. 72, March, 1909, p. 225) points out that the palm in French West Africa is a plant of the coast region. The most flourishing, natural groves are concentrated in a belt of country near the sea, and the palm looses its luxuriant character towards the interior owing to the insufficiency of moisture for vigourous growth. At high altitudes it is found to disappear and the best returns are given by trees in the low country where the soil is alluvial, well drained, rich in humus and damp, without being marshy. In somewhat poor soils near the coast the Oil Palm is also found to flourish and this appears to be due to the excellent physical constitution of the soil combined with a sufficient degree of humidity.

Plantations.

Very little appears to have been done by the natives of West Africa in making definite plantations of the Oil Palm. It is looked upon by them as a protected tree, and is rarely destroyed when land is cleared for cultivation, thus, as Thompson points out:—

"Where Oil Palms already happen to exist in fair numbers when the land is cleared for farms, seedlings sprout up in immense numbers about a year or two after the clearings are first made, from seeds dropped several years before. These seedlings are frequently thinned out and planted all over the farms, this being usually done in the rainy season. With the above exceptions no particular efforts are made to stimulate the natural regeneration of the species.

"Very little planting seems to be undertaken by the natives in other parts of Southern Nigeria. The large numbers of Oil Palms

met with in well cultivated districts of the Eastern and Central Provinces are due to spontaneous growth that springs up under the protected mother trees when these areas are cleared for farms. At each successive felling rotation of the forest growth that springs up on the fallow land, more seedlings sprout up and are in their turn spared from destruction. The area thus eventually becomes thickly covered with that species."

In the Gold Coast Mr. Evans states that :—

"The Krobos are the only natives who really pay any marked attention to the cultivation of Oil Palms. Their plantations, which are said to have been planted with Oil Palms about 40 years ago, are an example of native industry not at all compatible with the reputation which is often attributed to the natives of this Colony. All decayed branches are cleared off, and the heavy shade of the palm trees prevents the growth of weeds, so that the plantation presents a very tidy appearance; and it would well repay natives from other parts of the Colony interested in the palm oil industry to pay these plantations a visit."

The cultivation of the Oil Palm appears to have reached a higher state in the French Colonies than in our own. In Dahomey the increased facilities for transport due to the railway have led to a marked encouragement of the Oil Palm industry. Between Porto Novo and Sakété all the palms are said to be cultivated, the groves are cleared in great part, maize, manihot, and other food plants being grown amongst them. The Oil Palms benefit from attention given to the soil, but unless manure is given its fertility will naturally tend to diminish owing to the constant succession of crops.

In Guinea, M. Adam describes and figures the plantations of Pine-apples and Bananas which have been made in the palm groves of Camayenne, near Konakry, which appear to be in a flourishing condition.

M. Adam in the last published number of the French Colonial Bulletin (No. 72, pp. 229–243) deals at length with the question of the cultivation of the Oil Palm and particulars are given of the mode of clearing the ground, planting of the seeds, &c.

The nursery should be situated near a pool or water-course in order that the proper humidity of the soil may be assured. If this is not possible seeds should only be sown at the commencement of the rainy season. A light shade for the soil, either natural or artificial, is also essential.

The seeds, which should have been recently collected, germinate in four to five weeks and should be planted in the nursery at distances of about 18 inches apart.

Young plants found in the bush or those raised in the nursery should be planted out when they are from 2 to 3 feet high, that is when they are from one to two years old. The plants submit to transplantation more readily than other palms so that it is not necessary to raise the seedlings in pots.

The young plants should be placed at distances of 20–26 feet apart though the exact distance is dependent on the fertility of the soil. If, however, it is intended to have permanent intercalary cultivation in the plantation the distances between the palms would

have to be increased. In Dahomey according to the figures from various parts the average number of palms to the hectare (2 acres, 1 rood, 35 perches) is about 124.

Careful particulars as to the mode of preparation of the holes and as to the planting of the young palms are also given. Under the heading "maintenance" the importance of attention being paid to the young plantation is emphasised. M. Adam has noticed the following succession of intercalary crops in the palm groves :—

(1) Maize for several years.
(2) Equally during several years, alternate crops of different beans, ground nuts and sometimes yams.
(3) Manihot (cassava) as long as it yields crops, usually from three to four years.

The ground is then left fallow for 15–20 years or more and then the same succession is grown.

The ground is considerably depleted by these crops especially by the cassava, though it gains something from the leguminous plants, and the natives never apply manure. On the question of manuring M. Adam offers some interesting suggestions, which are worthy of consideration. He refers to the complete liberty of cattle and sheep, in consequence of which there is no supply of manure for the crops and suggests that there is a possibility of remedying this state of affairs. He also calls attention to another source of fertilizer for the soil of the plantations at present neglected namely the waste products of the Oil Palms themselves, such as the remains of the fruit pulp, the infloresences and the old leaves. Analysis has shewn that these products are of considerable value, and M. Adam concludes that had some of these neglected means of fertilizing the soil been employed the gradual diminution in the yield of the palms noticeable in many places would not have been witnessed.

In Southern Nigeria it has been noticed that trees growing on old farms are more prolific than those growing in the dense forest. This is due partly to the greater exposure to sunlight that the palms experience on the farms, and partly to the greater amount of attention they receive in the matter of trimming the leaves, &c., on such areas. There appears to be no doubt that tended trees give a greater yield of nuts than those growing uncared for in the forests (Thompson).

The Acting Governor of Sierra Leone writes in his despatch :—

"That steps have been taken to encourage the Chiefs to cultivate the Oil Palm, and that prizes are given to those who plant the largest number of palm trees."

Yield of Nuts, &c.

The age at which seedling Oil Palms come into bearing varies slightly in different places, and appears to depend mainly on the situation in which they are planted.

M. Adam* gives an interesting general account of the Oil Palm, with excellent figures of the inflorescences. The palms commence

* Adam, J. L'Agric. pratique des pays chauds. Bull. Mens. du Jard. Col. No. 68, 1908, pp. 380–387, and figs. 5–10.

to flower usually in their fourth or fifth year, and sometimes in the third. At first male inflorescences only are developed, and it is not until one or two years afterwards that female flowers appear. In a few exceptional cases both male and female flowers are found in the same inflorescence (Adam, *l.c.*, p. 384 and figs. 8 and 9).

The fruits take from two to six months to mature, according to the season of the year at which the inflorescences are formed. In the Gold Coast, according to Evans, the young plants commence to yield their first crop of fruits when about five years old when grown in the rich alluvial lands, but not until the sixth or seventh year in the hilly country, and gradually to increase their yield for 60–80 years. Gruner, referring to the Oil Palm in Togoland, mentions the uncertainty which prevails as to the time of yield. According to some informants the palms commence bearing in their sixth year, and bear only two or three bunches of fruit, the fruits being small. During the next five years the number of bunches increases from 4–6 per year, and in the twelfth year the palm yields its full harvest. Freyburger, quoted by Gruner, states that the bunches of fruit do not become more numerous as the palm grows older, but that both the bunches and the individual fruits increase in size. A young palm, six years old, according to him, bears 1–6 small bunches of fruit, whilst one of 10–20 years of age—the most prolific period—has also 1–6 very large bunches with well developed fruits.

Thompson gives the following particulars as to the growth and yield of the Oil Palm for the Western Province of Southern Nigeria, in Egba land and around Agege :—

"On rich newly cleared forest soil, the Oil Palm is said to bear its first bunches of nuts when it is seven to eight years old. The first bunches are small, about the size of a man's fist, and from eight to thirty of them are formed on the plant annually. As the latter gets older, the bunches increase in size, and are reduced in number to from four to twelve. When the palm is fully grown, that is at about the age of from eight to ten years, the bunches of nuts reach their maximum size, and are developed at the rate of from two to twelve per tree per annum. This rate of yield is continued afterwards practically throughout the natural life of the palm.

"The limits between which the yield varies in the case of full-grown trees are given below :—

"(*a*) Full-grown trees yield from about two to twelve bunches of nuts annually, each bunch weighing from 20 to 56 lbs., according to size.

"(*b*) An average-sized bunch contains at least 200 nuts, and the weight of the latter varies from 7 to 21 lbs.

"(*c*) The annual yield in oil of a tree is at least 7½ lbs. in weight.

"(*d*) The yield of kernel oil is generally 25 per cent. of the nut oil, or one quarter of a gallon per tree per annum" (Thompson).

McLeod (Southern Nigeria) mentions fifteen years as the age at which the Oil Palm reaches its maximum yield, and states that this is maintained up to 150 years of age. According to Thompson and

others, 100–200 years appears to be the natural limit of life for the species.

"In the Akwapim district of the Gold Coast the average annual yield per tree is about eight bunches; but in the Krobo district, where the Oil Palms are well cared for, they are said to yield, on an average, about twelve bunches per tree" (Evans).

From the Gambia it is reported that one tree yields from three to five cobs per year. A ripe cob, when first cut, weighs from 12 to 23 lbs. The fruit when pulled from the cobs weighs from 8 to 13 lbs., and an imperial bushel of the kernels weighs about 52 lbs" (Sangster).

The full bearing power of a tree in Sierra Leone is given as between its fifteenth to its thirtieth year. Beyond the thirtieth year the amount of oil is said to decrease, but the cobs may increase in size; and the oldest trees may yield a large number of cobs, but very little oil. The accuracy of this information, however, cannot be vouched for (Haddon Smith).

The trees appear to be in flower throughout the year; and as different bunches of fruit ripen at different times, there are always some left on the trees. In the Gambia only one bunch of nuts is said to be ripe at a time. The collecting of the fruits takes place, as a rule, at two regular seasons, the time of which differs in different places according to the climatic conditions, as the following extracts indicate:—

In the Western Province of Southern Nigeria Thompson states that the two regular seasons for fruiting are in the small dry season (August to September), and again from the Harmattan up to about the beginning of the tornadoes, *i.e.*, from the end of December to the middle of March.

"There are two crops, one harvested in the dry season, January to March, and the other between the two rains, *i.e.*, in August. The former crop is the more abundant" (McLeod).

In the Gold Coast "the principal collecting seasons are from May to July, and from November to February, the latter season being said to give the largest percentage of oil" (Evans).

"The natives of the Benin City districts (Southern Nigeria) never remove all the bunches of nuts at any one operation. A bunch is always left on each tree as a kind of 'Ju-ju,' and they assert that if this was not done the tree would soon die. This is an advantage, as seeds are thus provided for natural regeneration, and are scattered about the farms by hornbills, squirrels, &c." (Thompson).

Supplies and Transport.

In the Director's letter to the Under Secretary of State for the Colonies, two questions were asked which are closely connected together:—(*a*) To what extent the existing supplies of Oil Palm kernels are taken advantage of by traders; (*b*) how far increased facilities of communication have tended to increase the quantity of palm oil reported during recent years. From the various reports it is clear that a much greater quantity of fruit is produced than is at present utilised either for local consumption or for the manufacture of oil.

The quantity of kernels or palm oil brought in by the natives seems to depend very largely on the facilities of communication, and wherever such facilities have been improved either by means of railways, improved roads, or by water, an increase in the amount of kernels or palm oil reported has quickly followed.

In Sierra Leone the wastage of fruits appears to be due to the sparseness of the population, but in the other Colonies it is without doubt owing to difficulties of transport.

The Acting Governor of Sierra Leone reports as follows :—

"Traders buy as much palm oil as is brought to them by the natives, and consequently the supply is never equal to the demand. In some parts where the palms are very thick, it is probable that all are not utilised on account of an insufficient population. The District Commissioner of the Panguma district reports that 'there are now sufficient palm trees to meet all possible demands for many years to come.' The District Commissioner of Sherbro states that "the population of the two districts is not sufficient to handle adequately the produce abounding in the country." This shows that the reason why the full benefits are not derived from the existing supply of palm oil and palm kernels is one of sparseness of population but not of want of willing buyers" (Haddon Smith).

From the figures given under the heading 'Exports' it will be seen that the completion of the railway in Sierra Leone has had a marked effect on the export of palm oil and kernels from the Colony.

According to the report from the Gold Coast it appears that only a very small proportion of the Oil Palm products is exported.

"All the palm oil and kernels brought to the various markets are readily purchased by the mercantile community. A quantity of the oil and kernels is utilised by the natives as food and for lubricating purposes, but by far and away the largest quantity is left to decay on the trees. I am inclined to think that not more than one-tenth part of the products of the Oil Palms in this Colony finds its way to the export market.

"The chief reasons why this industry has not been increasing of late years are :—

1st. Low price paid for the products.
2nd. Transport difficulties.
3rd. Lack of machinery.

"In 1883 palm oil realised 2*s.* 6*d.* per gallon ; at the present time it only realises about 9*d.* per gallon regardless of quality. Labour at the present time is about 100 per cent. more expensive than it was 20 years ago, so that although the farmer, at the present time, has to pay twice as much to prepare his product and take it to the market, he only realises about one-third of what he did 20 years ago. The result is that the farmers are leaving the palm oil industry and planting cocoa.

"It requires two carriers to convey the products which one man can produce, so that only one-third of the products that could be grown is grown ; the consequence being that, with the fall in prices of palm oil, the farmer is unable to pay the carriers the same rate of pay, and as the carriers will not work for less, but are asking for

a higher rate of pay, both the farmer and merchant are entirely in the hands of the carriers, and are almost compelled to pay the rates demanded by them ; otherwise the produce would never reach the market. The farmer has to give up his Oil Palm industry and turn his attention to products which are more remunerative, and in the Eastern Province at the present time the palm oil and kernel industries are gradually dying out, and this province is one of the finest oil-producing centres in the Colony " (Evans).

In the French Colonies the same story of unused products owing to insufficient means of transport is told ; this is particularly the case with regard to the region between the rivers Couffo and Mono in Dahomey where a great part of the products are still lost (Adam).

Northern Nigeria does not appear to export Oil Palm products at all ; it is reported that the natives extract the pericarp oil entirely for their own use and, since it does not pay them to carry the kernels any great distance overland to sell, a large quantity are wasted (Shaw).

From Southern Nigeria the tale of the waste of Oil Palm products is repeated, as the two following extracts show.

" It is not possible to state with any degree of accuracy the proportion of a year's crop which is exported by the merchant. There is no doubt that he buys all the natives bring him, and this amount is, in my opinion, a large proportion of the available supply within such areas as are served by easy land and waterways " (McLeod).

" It is not possible to say to what extent existing supplies of kernels are taken advantage of by traders, but there is no doubt that in the Central and Eastern Provinces, enormous quantities never find their way to the seaboard, and are allowed to rot unworked. Judged by the relative out-turn of kernels as compared with oil in the Western Province, and making a liberal allowance for the distant railway traffic included in the Lagos figures, it is estimated that at least 50,000 tons of kernels are lost each year in the central and eastern parts of Southern Nigeria " (Birtwistle).

The principal reason for the present waste of the fruit of the Oil Palm seems to be lack of adequate communication. Mr. Birtwistle makes suggestions as to the ways in which the difficulties may be overcome, and Mr. McLeod points out that the improvement in exports is due to the improved method of transport. This may also be seen from the figures given later. Mr. Birtwistle is of opinion that one of the principal factors to bring about an increase in the production of oil and kernels, if not the main one, is " for the merchants themselves to second the Government's work in rendering water transport easy, by establishing factories nearer the actual producer. Were this done, and free and open trade rendered possible within easy reach of the bush native, I am certain the exports would quickly increase, especially in kernels " (Birtwistle).

" I am of opinion that the yearly expansion of the palm oil and kernel trade of Southern Nigeria is almost entirely due to the opening up of new roads and waterways, and railway extension. A small increase may also be due to the more peaceful state of the country " (McLeod).

Mr. Evans (Gold Coast) concludes his report as follows :—

"With good macadamized roads, suitable for motor traffic, to convey the products to the coast, and cheap light machinery that would satisfactorily manipulate the oil palm fruits, the output of palm oil and kernels from this colony would rapidly increase, but unless these are available I am inclined to think the Oil Palm industry will eventually die out."

The Preparation of the Oil.

Pericarp Oil.—Very little advance appears to have taken place in the mode of preparation of palm oil, and the general quality of the oil produced does not appear to have undergone any marked improvement. Lagos oil still commands the highest price,* though some of the oil from Sierra Leone is said to be of equal quality. Whether the superior character of the Lagos oil is due to the character of the palms or to the method of preparation is not clear, but it would seem advisable that the mode of preparation of the oil should be carefully investigated in order that the best return may be obtained for this product.

In the *Kew Bulletin*, 1892, pp. 204–208, an account is given of the preparation of Lagos palm oil, and it is stated that "every stage in the manufacture . . . is marked by great care and cleanliness, and the result is a remarkably pure sample of oil." The description there given refers only to the Pericarp oil, and corresponds very closely to the reports of the process recently received.

In the Gold Coast the preparation of Pericarp oil is somewhat different from that in vogue at Lagos, and the following interesting account is taken from Mr. Evans' report :—

"Very little progress has been made to improve the process of extracting the oil, the same crude methods of preparation are still carried out, the only noticeable improvement being that the length of time allowed for fermentation has been shortened, and this has a tendency to give the oil a less offensive smell. In some districts iron pots have been substituted for the native clay pots, and this has a tendency to keep the oil purer . . . .

"After the bunches are cut, they are conveyed to the village or preparing pit ; the men cut up the bunches with cutlasses in order to assist the work of picking out the fruit, which is chiefly done by women and children. The nuts, after being picked out, are thrown into a shallow pit (a hole from two to three feet deep, lined with flat stones, and plastered with a compound of palm oil and ashes, the latter prepared by burning plantain leaves) sprinkled with a

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* "The following were the prices ruling in the Liverpool market at the end of May (1908) :—

	£	s.	d.
Lagos Oil	24	0	0
Calabar (selected)	23	10	0
Bonny/Opobo	23	5	0
Benin	23	0	0
Niger, Brass and New Calabar kinds	22	5	0

"It will be noted that Lagos Oil still heads the list, and realises £1 15*s.* per ton more than the Niger, Brass, and New Calabar Oils." (Birtwistle).

little water, and covered over with plantain leaves, weighed down by stones and left for about five days.

"During this period a slight fermentation takes place, which softens the fleshy coat of the fruit, and facilitates its easy removal from the nuts, which process is performed by beating the nuts with long wooden pestles. The women and children then take the mixture of pulp and nuts and lay it on a wooden framework placed over another hole, a little water is then sprinkled over it, and the pulpy mass is then covered up with plantain leaves and left for another five days. During this period a quantity of the oil is released, and drains down into the plastered hole; this is then put into old kerosene tins ready for market. This oil is said to be of the very best quality, it has a pleasant smell, and does not readily harden. The nuts are then picked out from the fibre, and placed in the sun to dry. The fibre is put into large iron pots filled with water, and boiled until the oil rises to the surface and is skimmed off. The refuse is then put into a bag, and the remainder of the oil is squeezed out.

"It will be seen that the native method of extracting palm oil is primitive, laborious and wasteful, both of labour and produce, and it is generally affirmed by the natives that the present price of palm oil does not pay them for the large amount of labour entailed in its preparation.

"The following interesting figures, as to the cost of producing palm oil and kernels, have been furnished to me by Konor Mate Kole, of Eastern Krobo, who owns one of the finest palm oil plantations in the Colony.

"Cost of collecting palm nuts and extracting one ton of oil, £11 13*s*. 4*d*.

"Price paid for one ton of oil by local merchants, £10 10*s*.

"Cost of breaking and picking one ton of palm kernels, £10. Price paid for one ton of palm kernels by local merchants, £5 12*s*. The local cost of transport from the plantation—two days' journey from the market—is 1*s*. 6*d*. per day" (Evans).

According to Mr. Dawodu, Assistant Curator, Southern Nigeria, it is the freshness of the nuts more especially that determines the quality of the oil produced, and oil expressed from nuts on the same day as they are picked is the best. For oil used locally this is, of course, possible, but in dealing with large quantities for export without the use of some mill (not yet invented) the nuts have to undergo a short period of fermentation to make the task of extracting the oil easier (McLeod).

In the Eastern Province, Southern Nigeria, according to Mr. Hitchens the collected cones from the three kinds of Oil Palm are not treated alike to ensure the softening and maturation of their drupels preparatory to the extraction of oil from the mesocarp. The drupels of No. 1 (Au-su-ku, soft-shelled nut) are softened and matured on the cones from which the greater number detach themselves and the drupels of Nos. 2 (Okpuorkpu—ordinary variety), and 3 (Af-fiako-jub—the king palm) are detached by hand and fermented in masses to soften. No. 3 is valued by the natives for its large seed (kernel) and not for its scanty supply of oil.

According to the report from Sierra Leone "there has not so far been any improvement by the natives in their methods of extracting

the oil. The oil differs in different parts of the Colony and Protectorate. The merchants state that some of the oil which they get in the district adjoining the railway line is equal to the best quality of Lagos oil and is superior to the Sherbro oil" (Haddon Smith).

In the Gambia the oil is extracted in a manner similar to that in vogue in Lagos.

"Pericarp oil or 'Tulu sayi' in Mandingo, is made as follows and is a dull red :—

"1st. The fruit is plucked from the cob and put into a large pot of water and boiled until the pericarp is loosened from the shell of the nut; the fruit is then put into a large wooden mortar, or 'Canong,' and worked about with a pestle until the pericarp is separated from the shell.

"2nd. Pericarp is then put into another pot of water and boiled until the oil comes to the surface of the water and the fibre sinks to the bottom.

"3rd. The oil is then separated from the water and is fit for selling.

"The red, or pericarp oil, is sold by the makers in Bathurst in large iron drums each holding 5 gallons, for these they get varying prices; in the rains and now (June 1908) 12*s*., and during the dry season as much as 18*s*. and £1" (Sangster).

Kernel oil.—The kernels of the Oil Palm fruits are exported for the most part and the oil is extracted from them in Germany, England, and elsewhere. A certain amount of kernel oil is made in West Africa, but the cracking of the shells is a laborious process and the machines which have been invented do not appear to give very satisfactory results, owing to the nuts, not being spherical, passing through them uncracked. In the Gold Coast two machines have been tried by the Government; in the case of one machine (Gwira), after an experiment with 38 lbs. of dried nuts, 26 lbs. or 68·42 per cent. remained unbroken and 3½ lbs. of kernels were obtained; on passing the 26 lbs. again through the machine 14½ lbs. of nuts remained unbroken. The other machine (Miller) appears to be somewhat more satisfactory for, after a trial with 2,050 nuts, 392 or 19·12 per cent. remained unbroken. The cost of picking out the kernels by hand is a very expensive part of the process. Since estimating labour at 1*s*. per day it would cost £1 3*s*. 6*d*. to produce 379 lbs. of kernels—the amount yielded by the machine—valued in the local market at 16*s*. From 1*s*. to 3*s*. must be deducted from this amount to pay for transport to place the kernels on the local market (Evans).

It is suggested by Evans that the cost of separating kernels and hulls could be considerably reduced by having a tank partly filled with salt water placed by the machine to catch the kernels and hulls as they fall out, as the kernels would float.

An account of the Miller machine was given in the Annual Report upon the Agricultural Department for 1903, and the following table quoted by Evans is taken from that report.

"The cost of labour in connection with passing 2,050 lbs. of nuts through the machine was 1*s*. 6*d*., and picking out the kernels £1 12*s*.

"The weight of kernels obtained was 3¾ cwts. 15 lbs.; while it cost 6*s.* to break by hand and pick sufficient nuts to weigh 56 lbs., as shown below:—

—	Men employed.	Time.	Cost of labour.	Quantity of kernels obtained.
			£ *s.* *d.*	lbs.
Passing 2,050 lbs. nuts through machine.	3	½ day	0 1 6	379
Picking out kernels ...	22	1 day	1 2 0	
Cracking nuts by hand and picking out kernels.	6	1 day	0 6 0	56

"It will thus be seen that with the assistance of the machine a hundredweight of kernels may be prepared for 7*s.* approximately, but when cracked by hand they cost 12*s.*, *i.e.*, the cost of labour is reduced 41 per cent."

The ordinary method in use in the Gold Coast for extracting the kernels is, after the nuts are dried, to break them separately with a stone, and to pick out the kernels. The nut-cracking machine is occasionally met with in the Colony, but it has not been taken to kindly by the natives.

In Southern Nigeria kernel oil is extracted by roasting the kernels, and collecting the oil as it oozes out, or by first heating them to a moderate extent only, and then cracking them and placing the broken kernels into water which is boiled, when the oil that floats to the surface is skimmed off and collected (Thompson).

In the Gambia a somewhat different process is resorted to:—

"The oil from the kernel ('Tenkulo tulu' in Mandingo) is whitish.

"1st. The nuts are cracked and kernels extracted.

"2nd. The kernels are then dried in the sun.

"3rd. The kernels are next beaten into flour in a mortar; and

"4th. The flour thus obtained is mixed up in cold water, and stirred about with a stick until eventually the oil rises to the surface, and is taken off.

"The white oil is generally sold in bottles, for which 9*d.* and 1*s.* per pint bottle is charged. The traders up country pay 1*s.* for 16 lbs. of the kernels.

"This year there are a great many Karoni Jolahs, in Kombo, boiling oil and also selling kernels.

"There is a large sale for the oil both amongst the natives up country and the people of Bathurst, and for this reason the export is not very large" (Sangster).

The following account of the Oil Palm in the Gambia is taken from the third report on the Agricultural and Forest products of the Gambia, by Mr. G. C. Dudgeon, Inspector of Agriculture for British West Africa, published in the Gambia Government Gazette, March 6th, 1909, pp. 124, 125:—

"This Palm occurs throughout the lower river districts and is utilised by the Mandingos and Jolahs for the extraction of the red fruit or pericarp oil. As the process of extraction in the Gambia

differs somewhat from that employed elsewhere, it may be of interest to describe it here. There are usually three fruiting heads in each season, and there are two seasons in each year, during which the tree bears a crop, that yielded during the wet season being heavier than that of the dry. The weight of a head cut in the dry season may be over 20 lbs., the size having generally been diminished by the previous extraction of Palm Wine from the base of the fruiting stalk. The heads on one tree do not ripen simultaneously. When ripe they are cut down and the fruits are immediately extracted by hand ; the head being cut up to facilitate their removal. Winnowing, to get rid of the husk-like covering, with which each fruit is enveloped, is then resorted to, and the clean fruit is placed in a pot to boil until the fibrous pericarp is sufficiently loosened. No decomposition is permitted in order to assist this operation. When the pericarp has swollen, and is therefore more easily detached from the stone, the whole is placed in a mortar and pounded until the kernel stones can be picked out. The remaining pulpy, fibrous liquid is then squeezed through a strainer made from the fan palm leaf, and the liquid resulting is again boiled until the oil rises to the surface and can be skimmed off by means of gourd ladles.

"Kernel oils, both black and white, are said to be prepared by the Mandingos, in a manner which has been described with reference to other West African tribes, but the Jolahs only prepare the kernels for sale in Bathurst, where there is a small trade. All the pericarp oil that is made is consumed in the country.

"On examining the fruits, their small size is particularly noticeable, and the pericarp is very thin. In size those which are examined in Fongi (Jolah country), seemed to be approximately 1 in. by $\frac{4}{5}$ in. by $\frac{1}{2}$ in., and of a bright orange colour, without any black at their apices ; but the black-tipped form is said to occur, and the Mandingo trees are said to give a larger fruit. Only one variety is recognised by the natives, the kernel shell of which is very thick, and the native names applied to the tree itself are 'Tengo' (Mandingo), 'Kabekalako' (Jolah), and 'Neul' (Joloff)."

Exports.

It has already been indicated that the supply of palm oil and kernels for export is largely bound up with questions of transport and means of communication. The kernels are imported in some quantity into Liverpool, but the bulk of the carrying trade is in German hands, and the kernels are shipped to Hamburg (Hillier in *K.B.*, 1907, p. 62).

From the statistics published by the various Colonies there appears to have been a marked increase in the export of kernels, but a decrease in some cases in the last year in the export of oil. In Southern Nigeria the following extract represents the present condition of the Oil Palm industry :—

"No definite figures are available to show the extent to which the production of palm produce has been increased owing to improved means of communication, but there is no doubt that the

exports have been expanded by such means. Up to 1904, the export returns published here included oil and kernels from Porto Novo, which were shipped viâ Lagos, so the figures until 1905 cannot fairly be quoted. Since then, however, there has been a very marked increase, as will be seen from the following returns :—

Exports (excluding produce of Dahomey).*

—	Oil.	Kernels.
	Gallons.	Tons.
1905	14,157,384	108,817
1906	16,032,571	113,347
1907	18,332,531	133,630
1908	17,757,187	136,601

"Doubtless the extremely high prices ruling for oil and kernels during the greater part of 1907 afforded the natives an extra inducement to work palm produce more freely than usual, but a large proportion of the increase must be set down to better transport facilities and more settled conditions. There was nothing abnormal about the rainfall of 1906 to account for the large production of 1907, but the climatic conditions may be said to have been not unfavourable" (Birtwistle).

With regard to the Gold Coast, the figures for 1908 are not yet to hand, and the quantity of oil and kernels exported in 1905 is not given in the Colonial Report. The following table, however, shows the position of the industry up to the end of 1907 :—

—	Oil.	Value.	Kernels.	Value.
	Gallons.	£	Tons.	£
1905... ...	—	88,359	—	78,625
1906... ...	2,143,118	125,008	9,355	80,834
1907... ...	1,867,945	119,468	9,753	101,822

Mr. Evans gives some interesting details in his report on the yield of kernels by a tree, and as to the number of trees which would give the present output of oil and kernels from the Colony. His remarks are as follows :—

"The export of palm oil for 1907 was 1,867,945 gallons ; this quantity could be produced by 933,972 trees, covering an area of some thirteen square miles of land, each tree yielding, say, 12,000 nuts, weighing about 160 lbs. Taking the fresh nuts to yield 10 per cent. of oil, this would give about two gallons per tree per annum. The weight of kernels from the same tree would be about 24 lbs.,

* The figures have been taken from the "Government Gazette Extraordinary," Southern Nigeria, No. 46, July, 1908, and Southern Nigeria "Government Gazette," January 20, 1909. An interesting chart, showing the quantity of palm oil and kernels exported from the colony of Lagos from 1896 to 1905, is given in the Col. Rep. Ann., No. 507, Southern Nigeria (Lagos), for 1905.

so that it would take 94 trees to produce one ton of kernels, or 916,782 trees to produce the present export of palm kernels from this Colony."

The report of the Acting-Governor of Sierra Leone is of interest, since the effect of the completion of the railway on the exports of oil and kernels is well seen ; to quote from the report :—

" I attach a statement made by the Collector of Customs which gives the quantity of palm oil and palm kernels exported from this Colony in the period preceding the completion of the railway, and also in the period succeeding the completion of the railway. This return clearly indicates that improved facilities of communication have caused an increase in the exports of palm oil and palm kernels." *

Preceding Completion of the Railway.				Succeeding Completion of the Railway.		
——	1903.	1904.	1905.	——	1906.	1907.
	Tons.	Tons.	Tons.		Tons.	Tons.
Palm kernels ...	22,760	25,101	28,154	Palm kernels	30,375	34,942
	Galls.	Galls.	Galls.		Galls.	Galls.
Palm oil ...	232,000	241,131	266,012	Palm oil ...	375,573	615,997

(Haddon Smith).

The export of both oil and kernels from the Gambia is very small, and, according to the Governor's report, only a small quantity of the oil is used locally, as the natives prefer ground-nut oil. From the figures published in the Colonial Reports, however, it will be seen that there is a continued increase in the quantity of kernels exported. There is no return given for the oil.

Palm Kernels.

——	1904.	1905.	1906.	1907.
Tons ...	179	227	256	342

Palm Wine.

In addition to the palm oil industry, the Oil Palm yields palm wine, which is much appreciated by the natives. The trunk of the palm is tapped by making deep incisions in the upper portion whence spring the leaves. According to a note in *Der Tropenpflanzer* No. 12, 1908, p. 585, the capacity for production of the Oil

* *See* also Col. Rep. Ann., No. 531, 1906, Sierra Leone, p. 15, where the exports from Freetown and Sherbro are set out in detail, and the effect of the railway extension is discussed.

Palm is much diminished by tapping for the wine; 50 to 200 litres of sap may be drawn annually from a single tree and a vigorous palm may yield a daily supply of four litres for two months without intermission. Owing to the constriction of the stem of a tapped palm the top is liable to be blown off in a tornado.

Serious loss of Oil Palm fruits occurs also in the British Colonies. In Southern Nigeria the reports by Mr. Birtwistle and Mr. Thompson refer to the destruction caused by tapping for palm wine. Mr. Evans also reports in the same sense for the Gold Coast.

"One common cause of lessened production in a portion of the Western Province which I have just visited is the collecting of palm wine from the Oil Palm, which renders the tree barren, or practically so. Not content with bleeding a standing tree, the natives of some districts wantonly cut down Oil Palms in order that they more readily obtain a good supply of wine" (Birtwistle).

"In the Oka district of the Onitsha hinterland (Central Province), I have seen the Oil Palm extensively tapped for palm wine and the tree is frequently killed by the process" (Thompson).

"It is very difficult to give with any degree of accuracy the number of palm trees cut down annually for extracting palm wine, but there cannot be many less than 100,000 throughout the Colony and Ashanti.

"In some cases it is beneficial to thin out the trees, they are often too close together, and it can do no harm by cutting out the trees in the semi-open country near the coast. Generally speaking, I do not think there is much damage done through felling trees for palm wine.

"The method for extracting the palm wine is:—

"The tree is felled and allowed to lie on the ground from 3 to 21 days, sometimes longer, but it is generally acknowledged that it gives a very poor yield of palm wine if it is allowed to remain on the ground longer than three weeks before tapping.

"The crown of the palm is cleared of old leaf stalks, and a small hole is made about four inches square. The depth depends upon the thickness of the palm, the whole of the young leaves, which are used as palm cabbage, are cleaned out of this hole, and then another small hole is made inside the square hole, and a reed inserted with the end leading into a vessel to collect the wine. Twice daily the wound is renewed by cutting a small slice in this hole towards the crown of the palm; after about three days a torch, made of the dead leaf-stalks of the palm, is lighted and blown in front of the wound to kill all insects that may have got in the wound.

"The wine continues running from four to six weeks; after that period it is only used for medicinal purposes.

"The quantity of wine given by one palm varies considerably, but the natives state that the greatest quantity given by one tree is about 26 gallons.

"I have, on several occasions, tried to tap the standing trees, but with very poor results, the yield being about one gallon per tree, and the trees afterwards dying" (Evans).

In the third report on the Agricultural and Forest products of the Gambia, by Mr. G. C. Dudgeon, Inspector of Agriculture for

British West Africa (Gambia Government Gazette, March 6th, 1909, p. 125), the following account is given of the extraction of Palm Wine :—

" The extraction of wine from the Oil Palm has probably much to do with the diminutive size of the fruits in the Gambia, and this is practised upon every palm tree in the Jolah country and most of those in the Mandingo. Plantations of small groves or clusters are often seen close to the stockaded villages in Fogni, and it is evident that the palm tree is more valued for the wine than for the oil yielded. The method of extraction is worth notice, owing to the fact that the tree is so carefully treated that it is kept alive for a number of years ; which is not the case elsewhere in West Africa. The collector climbs the tree by means of a palm fibre sling, which passes round his waist and encircles the tree. By leaning backward the sling supports his body while he is able to walk up the trunk, pushing the sling upwards as he ascends. The leaves are cut from beneath one of the fruiting heads, to the stem of which is slung a ' bully ' or small gourd for the reception of the wine ; a hole being then cut with a round-faced chisel below the base of the fruit stem, and the wine conducted into the gourd by means of a funnel made from plaited palm leaves kept in position by a palm thorn. The gourd remains in this position throughout a night, when it is removed, and the hole is deepened before applying a second gourd for another night. This process is continued for five nights, after which the fruit head is cut for making palm oil, and a similar attention is accorded to the next ripening head on the tree. The terminal shoot is not injured, so that although the tree must be greatly weakened from constant tapping it does not die for a considerable time."

The Oil Palm outside West Africa.

The Oil Palm is also found on the N.W. shore of Lake Nyasa, in Zanzibar, and in the Island of Pemba. From the latter place, in 1903, 104,301 lbs. of kernels were exported to the value of £330 and in 1904 the value of the kernels exported was £384 (Cons. Rep. Ann., No. 3263, p. 18, No. 3716, p. 9). Since 1904, however, no returns of palm kernels appear to have been made for the Island of Pemba. The Oil Palm has been introduced into most of the tropical botanical gardens, but except in the case of some plantations in British North Borneo, no efforts appear to have been made to cultivate this palm outside West Africa.

In August last a copy of a despatch from the Governor of Southern Nigeria was received at Kew, through the Secretary of State for the Colonies, in which the suggestion is made that the cultivation of the Oil Palm should be taken up in other Crown Colonies and that Government plantations should be made. In reply to this suggestion it was mentioned that there appeared to be no reason why the Oil Palm should not flourish in such places as British Guiana, Trinidad, East Africa, Ceylon, the Malay Peninsula, &c., provided the conditions of moisture, &c., required by the palm were carefully considered in selecting the site for a plantation. It was also pointed out that, since reports showed that there was at

present a great wastage of Oil Palm products in West Africa and that the industry is capable of much greater development in that region it is somewhat uncertain whether Oil Palm plantations in other Colonies would prove a commercial success.

Moreover, as was pointed out in the former article (*K.B.* No. 2, p. 47), it will be necessary before making extensive plantations in West Africa to learn more about the different varieties of the Oil Palm. It is equally important that plantations should not be made outside West Africa until it is known that the best varieties of the Oil Palm can be raised true from seed.

An account of the ill-fated Oil Palm plantation at Daat, in British North Borneo, is given in the *Bulletin*, 1889, pp. 259–267.

Reports of other plantations in Borneo amongst the Kew records give somewhat conflicting accounts. According to Dr. P. Leys—writing in 1891—the Oil Palms were not a success though grown on especially good soil, and those moved to a higher and damper spot were a still greater failure. The amount of oil produced was small and the heads of fruit much smaller than in West Africa. Dr. Leys arrived at the conclusion that the cultivation of the Oil Palm in Labuan would not pay. This probably refers to the Daat plantation.

According to the Superintendent of Agriculture, British North Borneo (letter, May, 1890), the trees, obtained from seeds supplied by Governor Leys, were only used for ornamental purposes, for though they fruited freely no oil was produced.

From a printed report (1891) of another plantation, however, a different account is given. From a plantation of 40,000 young trees on the Quop estate (Sarawak) it appears that plenty of oil was obtained, but a difficulty was experienced in finding a market for the oil. It would be of interest to know the subsequent history of this plantation.

In a letter of the date November 26, 1891, from Sandakan, N. Borneo, Mr. H. Walker speaks of the "rich growth of African Oil Palm planted in 1882–83 from seed, I believe, obtained from Kew. These are now seeding freely, and must have been doing so for some years, as plants grown from seed produced here are now also bearing." It seems possible that some portion of the failure of these plantations may have been due to seeds of a poor variety of the Oil Palm having been sent to Borneo from West Africa, since in the case of the Quop estate the experiment appears to have been attended with success.

With regard to the Malay Peninsula, Mr. Carruthers, late Director of Agriculture and Government Botanist, Federated Malay States—in a letter of the date January 9, 1909, to the Governor, which has been forwarded to Kew by the courtesy of the Secretary of State for the Colonies—reports that there are 35 specimens of *Elaeis guineensis* in the experimental stations and Botanic Garden, which were raised in 1903 from seed obtained from the Royal Botanic Garden, Ceylon. Mr. Carruthers continues :—

"They average now at six years of age about 12 to 15 ft. in height, but have shown no sign as yet of flowering or fruiting; whether the absence of a dry season and the fact that the trees

never have a dry wind, such as is supposed in West Africa to assist in ripening the fruit, will be a continuous deterrent to the flowering and fruiting of the palms I cannot as yet give any opinion. The Oil Palms here are growing on low-lying and well-watered land, as well as on drier slopes. Until they fruit it is not possible to estimate what crop would be obtainable from each plant, or whether the variety we have is of one which is commercially valuable. . . .

"I am a little doubtful as to the suitability of this cultivation for the native or for the Chinaman. The gathering, the comparatively lengthy process of extraction of the oil, and the tiring nature of these processes will not commend themselves to the Malay, especially when he can by the easier task of cocoanut cultivation probably get as large a monetary return as by growing the oil nut palm. . . .

"The rubber industry is so attractive to the European investor and planter that I do not think the trial of an area of African Oil Palm would attract him unless he were given special rates for this land by Government."

In the Agricultural Bulletin of the Malay States for 1907, pp. 37–40, Mr. Ridley gives a short account of the Oil Palm, with a photograph of a fine example growing in the Botanic Gardens, Singapore. He says: "The tree on good ground here certainly fruits well, but no record has been kept of the weight of fruit produced. Dr. Preuss, when on a visit to the Gardens, expressed surprise at its fertility, and was still more surprised that it was not cultivated largely in a country so well suited to it."

Mr. Ridley expresses the view that it would be well worth while to cultivate the Oil Palm in the Malay Peninsula.

Though there is a considerable amount of evidence to show that the African Oil Palm will flourish in other tropical countries, it is not quite clear whether it would yield a good crop of fruit or prove a commercial success, and any planting which may be done, either in West Africa or in other countries, should in the present state of our knowledge be of an experimental character.

Concluding Remarks.

In conclusion, reverting to the questions put forward by the Director of Kew, it has been shown that:—

(*a*) The existing supplies of Oil Palm kernels are not taken full advantage of by traders in Sierra Leone. The fruits are allowed to go to waste owing to the sparseness of the population, but in the other colonies kernels are not brought into market owing to difficulties of transport.

(*b*) The question of the thin-shelled variety of the Oil Palm has been dealt with in the previous paper, and it has been pointed out that careful experimental work is needed before any extensive planting with the seeds of a particular variety is undertaken.

(*c*) Increased facilities of transport have resulted in an increase in the palm oil and kernel trade, and it is shown in

the reports that wherever railway extension has taken place, or other facilities of transport have been improved, there has been a marked expansion of the Oil Palm industry.

(*d*) As to the quality of the oil produced, very little change has taken place in the methods of preparation. The Lagos oil commands the best price, but there appears to be no reason why oil from other parts should not be of equal value with Lagos oil, since some of the oil from Sierra Leone is said to be of the same quality. It is possible that further improvement could be made to enhance the value of the Lagos product.

(*e*) Little light is thrown on the question as to how far the higher quality of oil from a variety of Oil Palm, the kernels of which may yield a smaller quantity of oil, compensates for the larger quantity that may be yielded by other known varieties, since the natives do not trouble to separate the nuts of the different varieties in extracting the oil, and mainly direct their attention to the oil obtained from the pericarp. It has been shewn that the pericarp in some varieties yields a high percentage of oil as compared with other varieties, but it appears that the trees of these particular varieties are rare. Careful chemical investigation will be required before this question can be answered in a satisfactory manner.

(*f*) The question as to the relative abundance of the varieties has already been answered.

(*g*) With regard to the degree of moisture in the soil, required to ensure a maximum yield of oil, the reports are somewhat conflicting. One point is clearly brought out that the Oil Palm will not grow in a swamp, but that the ground should be moist and well-drained, and the rainfall should be above 50 inches. Although the Oil Palm will grow in damp places and also on well-drained hillsides, statistics are not available to shew the effect on the yield of different situations. The amount of organic matter in the soil is a factor of especial importance for the successful growth of the Oil Palm since the amount of water held in suspension in the soil is largely dependent on the proportion of decaying vegetable matter which it may contain.

(*h*) The country suitable for the successful growth of Oil Palms extends from Sierra Leone to Angola and forms a belt varying from 60–180 miles in breadth, a great deal of land not now covered by palms is suitable for their growth, and it is estimated that about $\frac{3}{4}$ of the territory of Southern Nigeria may afford suitable conditions of moisture &c. for the successful cultivation of the Oil Palm. Outside West Africa, the Malay Peninsula, Borneo and other tropical localities seem to afford the proper conditions for the growth of the palm,

but there is not yet sufficient evidence to justify planting without further experiment.

(*i*) As to the number of seasons during which the Oil Palm maintains a maximum yield reports differ. In some accounts the maximum yield is said to be given when a palm is 10 years old, and in others the age is said to be 12 or 15 years. Again the 10th–20th years are said to be the most prolific period, but more commonly the 15th–30th year is given, though it is also stated that the palms will yield a full crop up to their 150th year. It appears probable, however, that after the 30th year, though the quantity of the fruit does not diminish, the yield of oil is somewhat lessened.

A List of Works on the Oil Palm.

Adam, J. "Le Palmier a huile et le Cocotier en Afrique occidentale française" in L'Agriculture pratique des pays chauds, Bulletin Mensuel du Jardin Colonial, 1908, No. 67, pp. 269–287, No. 68, pp. 380–389; No. 69, pp. 466–475; 1909, No. 70, pp. 35–46, No. 71, pp. 127–158, No. 72, pp. 219–243, to be concluded—with numerous illustrations.

The first paper deals with the habitat of the Oil Palm in the various French West African possessions, the second opens with a general description of the Oil Palm with excellent illustrations of inflorescences and Palms, followed by an account of the varieties of the Oil Palm which is continued in the two following numbers of the Bulletin.

In No. 71 the conditions of vegetation are dealt with and the relation between the rainfall and the yield of the palms is discussed, and it is shewn that the yield of nuts bears some relation to the rainfall of the preceding year.

No. 72 deals with the soil in which the palms flourish, the cultivation of the palms including the formation of the plantations and their maintenance; cultivation of other crops among the palms, and the question of manures. There is also a section dealing with the insect pests of the Oil Palm.

Almeida, J. J. de. "Noticia sobre a Palmeira de Dendem," Lisbonne, 1906; *see* Journal de l'Agriculture Tropicale No. 77, 1907, and 'L'Agriculture des pays chauds,' 1908, p. 466.

Drabble, Dr. E. 'Comparison of Palm Fruits from Various Districts on the West Coast.' Quarterly Journal, Liverpool University Institute of Commercial Research in the Tropics; ii., 1907, pp. 126–129. A short note on the possibilities of the Oil Palm in cultivation, iii., 1908, pp. 15–19.

Evans, A. E. "The African Oil Palm" in 'Tropical Life,' October, 1907, p. 146, with illustrations.

Gruner, Dr. "Die Ölpalme in Bezirk Misahöhe, Togo," in Der Tropenpflanzer, viii., 1904, pp. 283–291. A summary of this paper is given by M. J. Adam in 'L'Agriculture des pays chauds,' 1908, pp. 467, 468.

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Kew Bulletin, 'The Oil Palm in Labuan,' 1889, pp. 262–264. 'The African Oil Palm,' 1891, pp. 190–192, 'Lagos Palm Oil,' 1892, pp. 200–208, with illustrations; 'Economic Plants of Sierra Leone,' Oil Palm, 1893, p. 168.

Köhler. Medizinal Pflanzen, vol. iii., with plate.

Poisson, Jul. & Eug. "Note sur le Palmier à huile de la Côte occidentale d'Afrique," in Bulletin du Museum d'Histoire Naturelle, ix., 1903, pp. 410–415.

Preuss, Dr. Paul. "Die wirtschaftliche Bedeutung der Ölpalme," in Der Tropenpflanzer, vi., 1902, pp. 450–476.

Ridley, H. N. "The Oil Palm," in the Agricultural Bulletin of the Straits and Federated Malay Straits, vi., 1907, pp. 37–40, with plate.

Savariau, N. 'L'Agriculture au Dahomey,' Gouvernment Général de l'Afrique occident. Française, Colonie du Dahomey, 1906, p. 64.

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XIX.—DIAGNOSES AFRICANAE: XXVIII.

1011. **Pelargonium brevipetalum**, *N. E. Brown* [Geraniaceae]; affine *P. carnoso*, Ait., sed foliis bipinnatis, pedicellis brevissimis et petalis lutescentibus quam sepala brevioribus differt.

Caulis crasso-carnosus, ovoideus, supra terram 4–5 cm. altus, 3 cm. crassus, apice breviter ramosus, glaber. *Folia* laxe subrosulata, 9–19 cm. longa, 4–10 cm. lata, ambitu ovato-oblonga, bipinnatim divisa, crasse carnosa, minutissime subpuberula; pinnae utrinque 5–6, inaequaliter pinnatisectae, pinnulis utrinque 3–4 oblongis sublobatis apice dentatis subtruncatis. *Stipulae* 2 mm. longae et latae, late ovatae, obtusae, herbaceae. *Pedunculus* erectus, 25 cm. longus, superne ramosus, sub lente minutissime subpuberulus, foliis reductis 2–3 distantibus 1–1·8 cm. longis onustus. *Involucri bracteae* 2 mm. longae, ovatae, acutae. *Pedicelli* infra gibbam calycis tubi 3–5 mm. longi, distincte glanduloso-puberuli. *Sepalum* dorsale erectum, 7 mm. longum, 2·5–3 mm. latum, lanceolatum, acutum, viride, basi fusco-purpureo-maculatum; cetera reflexa, aequilonga, immaculata. *Petala* 5, subaequalia, quam sepala breviora, 5 mm. longa, superiora 4 mm., inferiora 3 mm. lata, elliptica, obtusa, pallide lutea. *Stamina* antherifera 5, cum stylo purpurea.

Cape Colony. Laingsburg Div.: near Matjesfontein, *Pillans*.

Described from a living plant sent by Mr. Pillans to the Royal Botanic Gardens, Kew, where it flowered in May, 1908.

1012. **Acridocarpus alopecurus**, *Sprague* [Malpighiaceae]; species distinctissima foliis elliptico-lanceolatis inconspicue brunneo-puberulis breviter petiolatis, rhachi inflorescentiae alopecuriformi.

Rami brunnei, striolati, glabrescentes, lenticellosi. *Folia* elliptico-lanceolata, apice breviter acute acuminata, basi obtusa, 10–13 cm. longa, 3·5–5 cm. lata, tenuiter coriacea, utrinque brunneo-puberula pilis exsiccando plerumque delabentibus, venis lateralibus utrinque 7–8 supra inconspicuis subtus satis manifestis, venulis utrinque inconspicuis; petioli 4–5 mm. longi. *Racemi* axillares; pedunculus circiter 1 cm. longus ut rhachis brunneo-pubescens; rhachis alopecuriformis, 1·5–3 cm. longa, circiter 3 mm. diametro paribus glandularum infra bracteas ornata; bracteae late deltoideae, 1 mm. longae, 1·75 mm. latae, pilosae; bracteolae similes et minores; pedicelli sub fructu 1·5–2·3 cm. longi, brunneo-pubescentes. *Mericarpia* 1–2 evoluta, 1 cm. longa, 6–7 mm. lata; ala ambitu naviculiformis, 4·5–5 cm. longa, 1·7–2 cm. lata.

Tropical East Africa. Pemba Island, *Miss Barraud*.

A. alopecurus runs down beside *A. chloropterus* and *A. katangensis* in the key (Journ. Bot. 1906, p. 201); but its real affinities are uncertain. From the shape of the bracts and the presence of glands on the rhachis it might be placed in the second group (p. 199), but apart from these characters it has but little in common with *A. Smeathmanni* and *A. congolensis*.

1013. **Indigofera stenophylla**, *Guill. et Perr.* var. **ampla**, *Sprague* [Leguminosae-Galegeae]; a typo et a var. *macrocarpa* foliolis latioribus, calyce grossius hirsuto, alis latioribus inferne densius villosis recedit; a var. *brachypoda* indumento grossiore, foliolis paucioribus longioribus, racemis longioribus distinguitur; a var. *Nyassae* caulibus hirsutis, foliolis latioribus, calyce patule hirsuto differt.

Rami validiusculi, leviter flexuosi, angulati, subappresse hirsuti. *Folia* 10–15 cm. longa, 2–3-juga. *Foliola* anguste oblongo-oblanceolata, apice obtusa vel rotundata, mucronata, 3–6 cm. longa, 7–14 mm. lata, discoloria. *Racemi* usque ad 13 cm. longi, floribus post anthesin deflexis. *Calyx* extra patule castaneo-hirsutus, pilis usque ad 1 mm. longis (in typo ad 0·5 mm. longis); tubus vix 1 mm. longus; lobi postici 3 mm. longi, anticus 5–6 mm. longus, laterales intermedii. *Petala* rubra (*Dodd*); vexillum suborbiculare, leviter retusum vel truncatum, cuspidatulum, 5·5–6 mm. longum, 4–4·5 mm. latum; alae 7 mm. longae, 2·5 mm. latae, extra inferne dense villosae; carina ut in typo. *Legumina* 4·5–5 cm. longa, 3·5 mm. lata.

Lagos. On the road to Abeokuta, *Millen*, 69; without locality, *Dawodu*, 290; Ogbomosho, *Bailey's Collector*, 3; in the dry zone, *Dodd*, 427.

The Lagos plant is here treated as a variety of *I. stenophylla* for the sake of uniformity with E. G. Baker's memoir on the Indigoferas of Tropical Africa (Journ. Bot., 1903, p. 260). *I. stenophylla* might, however, equally well be restricted to the type

and var. *macrocarpa*, and the three other varieties, *brachypoda*, *Nyassae* and *ampla*, could then be treated as distinct species.

1014. **Olea macrocarpa**, *C. H. Wright* [Oleaceae-Oleineae]; *O. laurifoliae*, Lam., affinis, foliis longe petiolatis fructuque oblongo recedit.

Rami teretes, tenues, cinerei, lenticellis instructi. *Folia* lanceolata, utrinque attenuata, 5 cm. longa, 12 mm. lata, supra nitida, obscure viridia, subtus pallidiora, minute punctata, glabra, ad margines incrassata revolutaque; petioli 8 mm. longi, supra canaliculati, subtus verrucosi. *Paniculi* ad ramorum apices terminales, multiflori, 4 cm. diam. *Calyx* cupularis, 2 mm. diam., breviter obtuseque 4-dentatus, ad margines puberulus. *Corolla* calyce ter longior; lobi oblongi, obtusi, apice cucullati. *Fructus* oblongus, 1·8 cm. longus, 8 mm. diam.

Transvaal. Zoutpansberg, "*D.F.O.*" 4829; forest near Pilgrim's Rest, *Grenfell*, 869.

1015. **Glossochilus parviflorus**, *Hutchinson* [Acanthaceae-Justicieae]; affinis *G. Burchellii*, Nees, sed foliis lanceolatis, calycis segmentis brevioribus, corollis minoribus differt.

Suffruticulus parvus, ramosissimus. *Rami* quadrangulares, pilis reflexis. *Folia* oblongo-lanceolata, acuta, basi attenuata, 1–1·5 cm. longa, 2–4 mm. lata, crassa, ciliata venis utrinque inconspicuis. *Calycis* segmenta 5, subaequalia, lineari-lanceolata, subacuta, 3·5 mm. longa, basi 0·5 mm. lata, 3-nervia, extra breviter glanduloso-pilosa, intus glabra. *Corolla* oblique infundibuliformis, superne leviter dilatata, 8 mm. longa, fauce circiter 3 mm. diametro, reticulata, lobis rotundatis subaequalibus. *Stamina* 4, inclusa; antherae 1 mm. longae, loculis subaequalibus, uno altius affixo, basi mucronatis. *Ovarium* ambitu oblongo-ovoideum, 2 mm. longum, 1 mm. diametro, superne parce longe pilosum; stylus 3 mm. longus, glaber, ramis brevissimis rotundatis. *Fructus* breviter stipitatus, ambitu oblongus, utrinque attenuatus, 2 cm. longus, 3 mm. diametro, puberulus. *Semina* compressa, crassiuscula, rugosa.

Transvaal. Piet Potgeiter's Rest, *R. Leendertz*, 1265.

1016. **Oxygonum fasciculatum**, *C. H. Wright* [Polygonaceae-Eupolygoneae]; *O. salicifolio*, Dammer, proximum, staminibus inclusis fructuque glabro recedit.

Caules ascendentes, rubescentes, leviter puberuli. *Folia* lanceolata, acuminata, 5 cm. longa, 10 mm. lata, basi attenuata, utrinque papillosa, integerrima; petioli 6 mm. longi, tenues; ochreae cylindricae, 8 mm. longae, membranaceae, setis pluribus tenuibus brunneis tubo paullo brevioribus instructae. *Racemi* terminales, ad 25 cm. longi; bracteae cuspidatae, setisque circa duabus lateralibus instructae; pedicelli bracteis paullo longiores, 2–3-natim dispositi. *Perianthium* campanulatum; tubus brevissimus; lobi 4 mm. longi, oblongi, obtusi. *Stamina* 3 mm. longa; filamenta tria interiora basi dilatata. *Stylus* staminibus brevior, ad medium divisus; stigmata subcapitata. *Fructus* triqueter, glaber, spinis tribus infra medium armatus.

Tropical Africa. Nile Land: British East Africa, Gilgil River, 1800–2100 m., *Scott-Elliot*, 6651; Ngomeni, in shallow sand,

Scott-Elliot, 6265. Mozambique District: German East Africa east shore of Lake Tanganyika, *Scott-Elliot*, 8322.

1017. **Oxygonum pubescens**, *C. H. Wright* [Polygonaceae-Eupolygoneae]; *O. delagoensi*, O. Kuntze, affine, fructu obovoideo 9-costato differt.

Caules ascendentes, 15–30 cm. alti, 2 mm. diametro, leviter sulcati, ad nodos vix incrassati, minute pubescentes; ochreae 4 mm. longae, setis tubo aequilongis. *Folia* linearia, 2·5 cm. longa, 1 mm. lata, acuta, puberula. *Racemi* laxi, 12·5 cm. longi; bracteae companulatae, cuspidatae, esetosae; flores 2–3-natim fasciculati; pedicelli bracteis longiores. *Perianthium* dilute luteum, campanulatum, 6 mm. longum, extra puberulum; lobi ovati, obtusi, 3 mm. longi. *Stamina* inclusa; filamenta 1·5 mm. longa; antherae coeruleae. *Fructus* obovoideus, 9-costatus, obscure puberulus; costae venis transversis connexae.

Tropical Africa. Mozambique District: Portuguese East Africa; Morebane Chara, 760 m., *Johnson*, 247. Rhodesia; Mashonaland, between Salisbury and Headlands, *Hon. Mrs. Evelyn Cecil*, 155; at Umtali, *Hon. Mrs. Evelyn Cecil*, 235A; between Umtali and Salisbury, *Hon. Mrs. Evelyn Cecil*, 44.

This species is allied to the South African *O. Dregeanum*, Meisn., which has perfectly glabrous stems and usually broader leaves.

1018. **Polygonum Schinzii**, *C. H. Wright* [Polygonaceae-Eupolygoneae]; *P. limbato*, Meisn., affine, foliis glabrescentibus bracteisque eciliatis differt.

Caulis robustus, glaber. *Folia* oblongo-lanceolata, basi apiceque acuminata, primum hispida, demum (costis exceptis) glabrescentia, 11·5 cm. longa, 2·5 cm. lata, marginibus undulatis; petioli 12 mm. longi; ochreae membranaceae, plus minusve campanulatae, primum hirsutae, demum glabrescentes, limbo herbaceo patenti instructae. *Racemi* axillares, saepius 3-natim dispositi, densiflori; bracteae dilute roseae, late ovatae, obtusae, eciliatae, 3 mm. longae; pedicelli bracteis aequilongi. *Perianthium* 4 mm. longum, infra medium 5-lobatum; lobi oblongi, apice rotundati. *Stamina* 7, perianthio paullo breviora. *Ovarium* compressum: styli usque ad medium conjuncti; stigmata subcapitata. *Nuculi* compresso-trigoni.

Tropical Africa. German South-west Africa: Amboland, Olukunda, *Schinz*, 499.

1019. **Rumex Woodii**, *N. E. Brown* [Polygonaceae]; affinis *R. cordato*, Desf., sed foliis lanceolatis basi acutis et fructibus majoribus facile distinguitur.

Herba 30–70 cm. alta. *Folia* radicalia cum petiolo 8–16 cm. longa, 1–4·5 cm. lata, lineari-lanceolata, lanceolata, elliptico-lanceolata, vel interdum hastato-lanceolata vel ovata, acuta vel obtusa, basi cuneato- vel attenuato-acuta, glabra; caulina gradatim minora; stipulae membranaceae, integrae, truncatae, 8–15 mm. longae. *Panicula* 7–20 cm. longa, aphylla, ubique glabra, ramis suberectis. *Flores* dioici. *Pedicelli* 4–9 mm. longi, filiformes, infra medium articulati. *Perianthii fructiferi* segmenta exteriora reflexa, 2·5–3 mm. longa, lineari-lanceolata, acuta, concava; interiora erecta, 11–17 mm. longa, 9–14 mm. lata, elliptico- vel orbiculato-cordata, obtusa, integra,

membranaceo-scariosa, reticulato-venosa, etuberculata, sed basi ad sinum callo parvo reflexo truncato vel obtuso instructa. *Achaenium* acute vel subalato-trigonum, laeve, brunneum, faciebus lanceolatis subacuminatis.

South Africa. Natal: Itafaman, *Wood*, 644; near Lambonjiva River, 4000 ft., *Wood*, 3583. Transvaal: north and south of Carolina in sandy soil, 5800 ft., *Burtt Davy*, 2714; Ermelo Experimental Farm, 5575 ft., *Burtt Davy*, 3919; Wemmers Hoek, Lydenburg, 5400 ft., *Burtt Davy*, 7625.

This species is also allied to the North American *R. hymenosepalus*, Torr., but is less stout, with smaller leaves, and the venation of the fruiting sepals is entirely different. As in the case of *R. cordatus*, Desf. the root of *R. Woodii* may be tuberous; its leaves and stems are often marked with bright red or scarlet patches formed of minute papillae, caused by a minute mite, probably some species of *Eriophyes*.

1020. Coelocaryon oxycarpum, *Stapf* [Myristicaceae]; fructu acuto a speciebus caeteris distinctum.

Arbor ramulis glabris teretibus. *Folia* obovato oblonga vel oblonga, acuminata, basi obtusa, 10–15 cm. longa, 5–6 cm. lata, tenuiter coriacea, in gemmis rufo-pubescentia, citissime glabrata, nervis lateralibus utrinque 6–8, petiolo 12–18 mm. longo flexuoso. *Racemi* umbellarum mascularum graciles, 3–5 cm. longi, ramis infimis 4–6 mm. longis, receptaculo discoideo 2–4 mm. diametro 10–25 flores gerente, pedicellis tenuibus ad 4 mm. longis. *Perianthium* 3-fidum, 1·5 mm. longum. *Antherae* 3, 0·3 mm. longae, stipiti aequilongae. *Flores* foeminei ignoti. *Infructescentiae* ex axillis foliorum summorum ortae, 5–8·5 cm. longae, glabrae; umbellae solitariae vel paucae in racemos dispositae, fructus 2–3 tantum maturantes, pedicellis subtenuibus 1–1·2 cm. longis. *Perianthium* persistens, 3-partitum, fere 2 mm. longum. *Fructus* ovoideo-oblongus vel ellipsoideo-oblongus, basi angustior, acutus vel subacutus, 2·5–3 cm. longus, pericarpio tenui glabro. *Semen* ellipsoideo-oblongum, testa brunnea laevi, endospermate fere ad centrum ruminato.

West Africa. French Guinea: Farana, in gallery woods, *Chevalier*, 13178, 13425.

XX.—PEGLERA AND NECTAROPETALUM.

O. Stapf and L. A. Boodle.

The genus *Peglera* was described by Dr. H. Bolus in the *Kew Bulletin* for 1907, p. 362, and placed near *Weihea* and *Cassipourea* in *Rhizophoraceae*. A figure of it was subsequently published in *Hooker's Icones Plantarum*, t. 2841. In the accompanying text it was pointed out that Dr. Bolus was not quite satisfied that he had correctly placed it, and that closer examination indicated relationships with *Irvingia* (*Simarubaceae*). Mr. Boodle at the same time stated that although the anatomy of *Peglera* agreed in some respects with that of the *Simarubaceae*, it differed in others.

Whilst the plate and letterpress for *Peglera* were prepared for the *Icones Plantarum*, I independently dealt with *Nectaropetalum Kaessneri*, which had also been selected for publication in the *Icones*. The two plates were accidentally placed next one another in the volume. It was then discovered, but too late for correction, that the figures of *Peglera capensis* and *Nectaropetalum Kaessneri* were so similar as to suggest that the species figured under those names were actually congeneric. Further examination left no doubt on that point, and *Peglera capensis* becomes now *Nectaropetalum capense*. *Nectaropetalum*, originally described by Engler as a genus of *Linaceae*, was transferred (*Icones Plantarum*, t. 2840) to *Erythroxylaceae*, an order not previously taken into consideration by Mr. Boodle in connection with *Peglera*. He extended, therefore, his comparative studies of the *Peglera* material to *Nectaropetalum* and the *Erythroxylaceae*, with the result that the generic identity of *Peglera* and *Nectaropetalum* and their place in *Erythroxylaceae* may now be considered as well established. Mr. Boodle's account is given below, whilst a revised description of *Nectaropetalum* and a clavis of the species is added here as a summary of our present knowledge of the genus.

Nectaropetalum, *Engl.* in Engl. Jahrb. vol. xxxii, p. 109 (emend.). *Erythroxylo* affine, sed ovario 2-loculari, stylo simplice stigmata 2 recurva gerente, petalorum squamis maxime reductis vel plane obsoletis et filamentorum tubo brevi vel brevissimo distinctum.

Calyx 5-(rarius 4-) partitus; segmenta triangularia, acuta, praeter margines crassiuscula, valvata (?). *Petala* 5-(rarius 4-) unguiculata, calyce pluries longiora, lamina ima basi squamula biloba minuta cum ea foveolam formante instructa vel nuda, sed ab ungue textura distincta. *Stamina* petalorum numero duplo basi in tubum brevem vel annulum connata; filamenta episepala breviora, epipetala longiora; antherae dorso infra medium affixae. *Ovarium* ovoideum, 2-loculare; ovula solitaria, ab apice pendula, raphe axiscopa; stylus simplex, antheras superans; stigmata 2, brevia, ovata, recurva. *Fructus* ignotus. *Frutices* vel arbusculae, ramis novellis basi cataphyllis (ramentis vel perulis) deciduis paucis obtectis. *Folia* papyracea vel subcoriacea, integra; stipulae intrapetiolares connatae (vel demum fissae ?), scariosae, sub 2-carinatae, acutae, longitudinaliter striatae. *Flores* axillares, solitarii vel pauci fasciculati, brevissime pedicellati, ut videtur albidi vel florescentes.

Species 3, in East and South Africa from Mombasa (Bome River), to the Kentani District in Transkei, Cape Colony.

Petala 3 cm. longa, ad laminae basin fovea instructa ... ... 1. *N. Carvalhoi.*

Petala 0·7–1·3 cm. longa.

Folia magis minusve elliptica, obtusa vel subacuta; petala ad laminae basin squama biloba instructa, quam stamina longiora; filamenta basi in tubum brevem connata... 2. *N. Kaessneri.*

Folia utrinque acuta vel apice acutissima; petala nuda, quam stamina breviora, filamenta ima basi in annulum connata ... 3. *N. capense*

Following the diagnosis of *Peglera capensis* and the remarks on the systematic position of this species in the *Kew Bulletin* (1907, pp. 362–3), a short description of the anatomical structure of the plant was given, and a comparison was made with the anatomical characters of the *Legnotideae (Rhizophoraceae)* and the *Simarubaceae*. The conclusion arrived at was that the genus *Peglera* "would find a more natural place in the *Simarubaceae* than in the *Legnotideae*."

A comparison has now been made between *Peglera capensis* and *Nectaropetalum Kaessneri*, and the agreement of the anatomy in these two plants proves to be sufficiently marked to establish a fairly close affinity between them.

The re-examination of *Peglera*, for the purpose of this comparison, has led to the detection of two characters, which had been overlooked at the time when the previous anatomical description of the genus was written. One of these is the presence of occasional scalariform perforations in the vessels, simple perforations being general in the wood, and those of the scalariform rare. The other character is the occurrence of cortical vascular bundles which, however, are restricted to a small portion of the internode just below the node.

The agreement between *P. capensis* and *N. Kaessneri* extends to most of the lesser anatomical details, while of the points of difference the chief are as follows: vascular system of midrib slightly simpler in *Nectaropetalum*; papillae on the lower epidermis of the leaf in *Nectaropetalum* but not in *Peglera*; cortical bundles extending throughout the internode in *Nectaropetalum*, but occurring only near the top of the internode in *Peglera*. The first two differences are quite unimportant, and the third, though considerable (*see below*), is one that would not be very surprising if found within the limits of a genus.

In *Nectaropetalum* two vascular bundles separate from the stele in the upper part of the internode and pass upwards, as cortical bundles, through the node and the next internode. They reach the second node, where apparently* each of them forks into two, one branch going to the leaf-trace, and one to the stipule. It follows that there are two cortical bundles in the lower part of an internode, and four in the upper part. Thus the behaviour of the cortical bundles is similar to that of the cortical bundles in *Erythroxylon*, except that in that genus, according to Van Tieghem,† the cortical bundles originate in the lower, instead of the upper, portion of the internode, and stop at the next node, instead of the next but one. In *Erythroxylon emarginatum*, Schum. et Th.,‡ the two cortical bundles originate practically at the node, but one or both may separate from the stele just before or just after the two cortical bundles from the node below pass out of the stem.§ Hence, as

* The material examined was insufficient for determining the relation of the cortical bundles to the stipules, &c., with certainty.

† Van Tieghem, Struct. et affin. des Erythroxylacées, Bull. Mus. d'hist. nat., ix. (1903), p. 289.

‡ Specimen from Namasi, leg. Cameron, No. 3.

§ In this case it was determined with certainty that each of these two bundles forks at the node, giving a small branch for the stipule, and a larger bundle, which fuses with one end of the median leaf-trace, as described by Van Tieghem.

regards the cortical bundles, this species forms a connecting link between *Nectaropetalum Kaessneri* and the species of *Erythroxylon* investigated by Van Tieghem. In *Peglera* four cortical bundles pass out separately from the vascular ring in the upper part of the internode, and stop at the next node, where they apparently behave in the same way as the four bundles due to sub-division of the two cortical bundles of *Erythroxylon*.

On account of the presence of cortical bundles in *Peglera* and *Nectaropetalum* (and especially the behaviour of these bundles in the latter genus), and the general agreement with the *Erythroxylaceae* * shown by the anatomy of the stem and leaf, there can be little doubt that these two genera belong to that family.

XXI.—NOTES ON THE INDIAN SPECIES OF SAMBUCUS.

J. Hutchinson.

Recent enquiries received at Kew regarding the occurrence of *Sambucus Ebulus*, Linn., in India have rendered it necessary to re-examine the Indian specimens referred to that species by the late Mr. C. B. Clarke and others.

In 1890 Dr. R. von Wettstein described a new species of *Sambucus* from the Himalaya under the name of *S. Gautschii* and referred to it the whole of the Kashmir material mentioned by Clarke under *S. Ebulus*. His description was drawn up from plants, raised in the Botanic Garden of the Vienna University, from seeds distributed by the Saharanpur Botanic Garden in 1886. Dr. von Wettstein was no doubt right in distinguishing this *Sambucus* from *S. Ebulus*, for the latter evidently does not occur in India at all; but he appears to have overlooked *S. Wightiana*, Wall. apud Wight and Arnott, a fairly good description of which is given in Wight and Arnott's Prodromus, p. 388; or he may have been misled by Clarke's identification of *S. Wightiana* with *S. javanica*. From an examination of the type specimen of *S. Wightiana* in Wallich's herbarium at the Linnean Society, consisting of a fruiting specimen, there is little doubt as to its identity with Clarke's "*S. Ebulus*" and Wettstein's *S. Gautschii*, and as *S. Wightiana* is much the earlier name it should in future be employed for the Kashmir plant. Unfortunately, however, there is some uncertainty about the origin of the type specimen of *S. Wightiana*. Wallich in the Catalogue (no. 6303), as well as on the label, quoted merely Hb. Wight, whilst Wight in his Catalogue (no. 1252) and in Wight and Arnott l.c. refers to Wallich. From the fact that the plant was taken up by Wight and Arnott in their Prodromus, it might be inferred that their specimen was from the

* Van Tieghem, l. c.; Solereder, Systematic Anatomy (*Erythroxylon* &c., under *Linaceae*), Eng. Ed., pp. 159, 847. The leaves of *Erythroxylon emarginatum* differ only in unimportant characters from those of *Peglera* and *Nectaropetalum*. The midrib is practically the same as in *Peglera*, and there are no epidermal papillae.

Peninsula ; but there is no other record of *Sambucus* occurring there. At the same time the specimen which Wight and Arnott mention as being in their possession and which might have some note concerning its origin attached to it is neither at Kew nor in the Arnott herbarium at Glasgow and is probably lost.

S. Ebulus is characterised by having erect stamens with purple anthers and somewhat large flowers ; whereas in *S. Wightiana* the stamens are spreading with yellow anthers and the flowers much smaller.

S. Wightiana is more closely allied to *S. adnata* Wall. from which it differs, however, in the glabrous or almost glabrous inflorescence, and, moreover, it is so far only known from Kashmir and Chitral, whilst *S. adnata* in India is confined to Nepal and Sikkim, extending in Tibet to Chumbi and to Western China. It appears therefore advisable to regard them at present as distinct species.

Short differential diagnoses of *S. Ebulus* and of the Indian species are given below.

S. Ebulus, *Linn.*

Herbaceous ; stems thick, dying down in winter. Stipules foliaceous. Leaflets in 4–6 pairs, the lower ones usually stalked, teeth not tapering into long points. Primary branches of the inflorescence 3, stout, glabrescent, leafy at the base. Flowers about 1 cm. in diameter, tinged with red. Stamens erect ; filaments dilated ; anthers purple. Fruits black.

Distribution :—Europe, northward to Sweden and the middle of Russia ; Madeira and North West Africa ; eastward to Northern Persia.

S. Wightiana, *Wall.* ex Wight & Arnott, Prodr. p. 388 (1834). *S. Ebulus*, Clarke in Hook. Fl. Brit. Ind. vol. iii. p. 2 ; non Linn. ; *S. Gautschii*, Wettst. in Oest. Bot. Zeitschr. vol. xl. p. 230, t. 2 (1890). Herbaceous ; stems as in *S. Ebulus*. Stipules foliaceous. Leaflets in 3–4 pairs, the two upper pairs often adnate at the base and decurrent, the lower ones sessile or shortly stalked, teeth tapering into fine points. Primary branches of the inflorescence 5, glabrous or sparingly and minutely papillose, not leafy at the base. Flowers at most 5 mm. in diameter, whitish-yellow or lemon yellow* (according to a coloured drawing by Royle and Carey in the Kew coll.). Calyx segments glabrous. Stamens spreading ; filaments not dilated ; anthers yellow. Fruits at first red, becoming black at maturity.

Distribution :—Chitral : Shandar Province, *Giles*, 650! Kashmir : Sonamarg, 8500 ft. *Clarke*, 30903 ! Sind Valley, *Thomson ! Henderson !* Kishtwar, 8000–9000 ft., *Thomson !* without precise locality, *Falconer !* Punjab : Chamba, Pangi Valley, *Ellis*, 3472 ! without locality, *Wallich*, 6303 !

Duthie, in a report on a botanical tour in Kashmir (Records Bot. Survey of India, vol. i., n.i., p. 43), mentions this plant (as *S. Ebulus*) as being a common weed near villages in the Sind, Liddar, and other valleys of Kashmir.

* Lawrence in his account of the Valley of Kashmir p. 92, gives the flowers as being white.

S. adnata, *Wall.* ex DC. Prodr. vol. iv. p. 322 (1830).

A shrub 3–6 feet high. Stipules small or much reduced. Leaflets in 3–5 pairs, otherwise as in *S. Wightiana* except that the teeth are not so much produced. Primary branches of the inflorescence 3–5, densely pubescent, usually leafy at the base. Flowers white, nearly 5 mm. in diameter. Calyx segments pubescent. Stamens as in *S. Wightiana*. Fruits red or yellowish-red.

Distribution :—Nepal : Gossain Than, *Wallich*, 482 ! Tambur river, berries red like currants, *Hooker !* Sikkim : Lachung Valley, 6000–10000 ft., *Hooker !* Phullaloong, Darjeeling, *Clarke*, 12681 ! *Gamble*, 96 D.! Tibet : Chumbi, *Dungboo*, 4533 ! Yatung, *Hobson !* Yunnan : in woods at La-long-tan, *Delavay*, 3781 ! Nantyen and Momien, *Anderson !* Szechuen : Tachienlu, *Pratt*, 122 ! *Hosie !*

S. javanica, *Bl.*, Bijd. p. 657.

S. rubra, Ham. Wall. Cat. 482 b.

This differs chiefly from the two preceding species in having free leaflets, wider, subthyrsoid inflorescences, sessile or subsessile flowers, and black fruits. Further, it is described as a large, virgate shrub or small tree.

Distribution :—Sikkim : Lebong, leaves boiled in hot water and used for injuries, *Hooker !* Upper Assam : Sadiya, *Griffith*, 769 ! without precise locality, *Jenkins*, 498 ! Khasia Hills : below Nunklao, *Hooker & Thomson*, 1625 ! Nurtiang, berries small and black, *Hooker & Thomson !* Bengal : Gongachora (near Rungpur), *Hamilton* in Hb. Wallich, 482 B ! Dacca (cultivated) 'same as wild in Mymensingh', *Clarke*, 7650 !

Occurs also in Sumatra, Java, and the Philippines.

Clarke identified *S. chinensis*, Lindley with this species, but to the writer it appears to be distinct. Lindley describes it as "a rank, weedy, herbaceous plant, with the aspect of *S. Ebulus*," characters which could not be applied to *S. javanica*.

XXII.—MISCELLANEOUS NOTES.

Mr. A. Osborn, Foreman in the Decorative Department, has been transferred to the Arboretum as Foreman in succession to Mr. W. Dallimore, promoted to an Assistantship [*K. B.*, 1909, p. 150.] The vacancy in the Decorative Department has been filled by the appointment of Mr. J. Coutts, who entered Kew as a young gardener in 1896 and who, after a period of service as subforeman at Kew, has since 1900 filled the position of head gardener to Sir T. Dyke Acland, Bart., at Killerton Park, Devonshire.

Sir George King.—Subjoined is a list of works by the late Sir George King, K.C.I.E., LL.D., F.R.S., in continuation of the notice which appeared in the present volume of the *Bulletin*, No. 2, pp. 68–72.

Notes on the lion of Aboo. (Proc. As. Soc. Bengal, 1868, pp. 198–200.)

On the birds of the Goona district. (Journ. As. Soc. Bengal, 1868, vol. xxxvii., pp. 208–218.)

Notes on the famine foods of Marwar. (Proc. As. Soc. Bengal, 1869, pp. 116–121.—Reprinted in Trans. Bot. Soc. Edinburgh, 1870, vol. x., pp. 239–245.)

The cultivation and extraction of China-grass-cloth or Rheea fibre. (Journ. Agric. and Hortic. Soc. India, 1869, n.s. vol. i., sect. 1, pp. 400–411.)

Indian Economic Botany and Gardening ; a review. (Calcutta Review, 1869, vol. xlix., pp. 187–205.)

Notes of vegetable products used as food during the late famine in Rajpootana. (Trans. Bot. Soc. Edinburgh, 1870, vol. x., p. 198.)

Report on the Dehra Dhoon Forests. Allahabad 1871. 15 pp.

Report on Forest Conservancy, etc., for Raneekhet. (Gazette of India for 1871, Supplement n. 34, pp. 1222–1231.)

Remarks on the pruning of Tea. (Journ. Agric. and Hortic. Soc. India, 1871, n.s., vol. iii., sect. 1, pp. 82–98.)

Annual Reports of the Royal Botanic Garden, Calcutta, Nos. [85, 87–89], 90–100, 102–109. 1872, 1874–87, 1889–97. (Report for the year 1886–87 reprinted in Journ. Agric. and Hortic. Soc. India, 1888, n.s., vol. iii., sect. A., pp. 25–33.)

History of the introduction of the medicinal Ipecacuanha plant into Bengal. (Journ. Agric. and Hortic. Soc. India, 1874, n.s., vol. v., sect. 1, pp. 46–48.)

Annual Report on the [Government] Cinchona Plantations [and Factory] in British Sikkim, Nos. 12–25, 27–29, 31–35. 1874–87, 1889–91, 1893–97.

Forest Flora of North-West and Central India, by J. L. Stewart, completed by D. Brandis ; a review. (Indian Forester, 1875, vol i., pp. 180–186.)

Directions for drying specimens of plants for a herbarium. Calcutta (Bengal Secretariat Press), 1875. 4 pp.

Botany. [List of the plants of the plains of the N.W. Provinces.] (E. T. Atkinson, Gazetteer of the N.W. Provinces and Oude, 1876, vol. iv., pp. 57–73.—List separately reprinted as Plants of the N.W. Provinces, pp. 1–20.)

A manual of Cinchona cultivation in India. Calcutta, 1876. Second edition, Calcutta, 1880.

Note on a sport in *Paritium tricuspe*, G. Don. (Journ. Linn. Soc., 1876, vol. xv., pp. 101–103.)

List of the principal plants growing in the Bengal Presidency and Assam. (By G. King and S. Kurz.) (W. W. Hunter, A statistical account of Bengal, 1877, vol. xx., pp. 121–127.)

A glossary of Indian plants mentioned in Sanskrit medical works with Bengali, Hindi and Latin synonyms. (U. C. Dutt, The Materia Medica of the Hindus. Calcutta, 1877.—Rev. ed. id., 1900, pp. 289–324.)

On the source of the winged Cardamom of Nepal. (Journ. Linn. Soc., 1878, vol. xvii., pp. 3–5.)

Sketch of the Flora of Rajputana. Calcutta (Government Central Press), 1878, 12 pp. (Reprinted in Indian Forester, 1879, vol. iv., pp. 226–236.)

Cinchona cultivation in Java. Indian Forester, 1880, vol. v., pp. 422–428.)

Directions for sowing *Pithecolobium Saman* seed, and for treating the young plants. (Journ. Agric. and Hortic. Soc. India, 1881, n.s., vol. vi., sect. 1, p. 256.)

List of the plants of Garhwál, Jaunsár-Báwar and the Dehra Dún. (E. T. Atkinson, Gazetteer of the N.W. Provinces and Oude, 1882, vol. x., Himalayan Districts, vol. i., pp. 299–322.)

On three new Himalayan Primulas. (Journ. As. Soc. Bengal, 1886, vol. lv., pp. 227–228, tt. 8–10.)

On two new species of *Ilex* from the Eastern Himalaya. (Journ. As. Soc. Bengal, 1886, vol. lv., pp. 265–266, tt. 13–14.)

On the fertilization of *Ficus hispida*: a problem in Vegetable Physiology. (Sc. Mem. Med. Off. Army of India, 1886, part 2, pp. 47–52, tt. 9–10.)

Observations on the genus *Ficus*, with special reference to the Indo-Malayan and Chinese species. (Journ. Linn. Soc. 1887, vol xxiv., pp. 27–44.)

On some new species of *Ficus* from New Guinea. (Journ. As. Soc. Bengal, 1887, vol. lv., pp. 394–411.)

A second series of new species of *Ficus* from New Guinea. (Journ. As. Soc. Bengal, 1887, vol. lvi., pp. 61–65.)

On some new species of *Ficus* from Sumatra. (Journ. As. Soc. Bengal, 1887, vol. lvi., pp. 65–67.)

On the species of *Loranthus* indigenous to Perak. (Journ. As. Soc. Bengal, 1887, vol. lvi., pp. 89–100.)

The species of *Ficus* of the Indo-Malayan and Chinese countries. (Ann. Roy. Bot. Gard. Calcutta, 1888, vol. i., pp. 1–185, tt. 1–225.)

Urticaceae: Ficus. (Flora of British India, vol. v., pp. 494–537: 1888.)

Some new species of *Ficus* from New Guinea. (Ann. Roy. Bot. Gard. Calcutta, 1889, vol. i., Appendix, pp. 1–51, tt. 1–5.)

The species of *Artocarpus* indigenous to British India. (Ann. Roy. Bot. Gard. Calcutta, 1889, vol. ii., pp. 1–16, tt. 1–14.)

The Indo-Malayan species of *Quercus* and *Castanopsis*. (Ann. Roy. Bot. Gard. Calcutta, 1889, vol. ii., pp. 17–107, tt. 15–104.)

Materials for a Flora of the Malayan Peninsula. Prefatory note. (Proc. As. Soc. Bengal, 1889, pp. 185–186.) Nos. 1–13. *Ranunculaceae–Cornaceae*. (Journ. As. Soc. Bengal, 1889, vol. lviii., pp. 359–408; 1890, vol. lix., pp. 113–206; 1891, vol. lx., pp. 38–140; 1892, vol. lxi., pp. 1–130; 1893, vol. lxii., pp. 87–137; 1894, vol. lxii., pp. 189–262; 1895, vol. lxiv., pp. 16–137; 1896, vol. lxv., pp. 339–516; 1897, vol. lxvi., pp. 1–345; 1898, vol. lxvii., pp. 1–63; 1900, vol. lxix., pp. 1–87; 1901, lxx., pp. 66–142; 1902, vol. lxxi.,

pp. 46–80.) [(By G. King and J. S. Gamble), 14–21. *Caprifoliaceae–Verbenaceae.* (l.c., 1904, vol. lxxii., pp. 111–229; 1904, vol. lxxiii., pp. 47–135; 1905, vol. lxxiv., pp. 1–386; 1907, vol. lxxiv., pp. 387–728; 1908, vol. lxxiv., pp. 729–916.)

The *Magnoliaceae* of British India. (Ann. Roy. Bot. Gard. Calcutta, 1891, vol. iii., pp. 197–223, tt. 38–74.)

The species of *Myristica* of British India. (Ann. Roy. Bot. Gard. Calcutta, 1891, vol. iii., pp. 275–331, tt. 106–174.)

A short account of Colonel Kyd, the founder of the Royal Botanic Garden, Calcutta. (Ann. Roy. Gard. Calcutta, 1893, vol. iv., pp. 1–11, Frontisp.)

The *Anonaceae* of British India. (Ann. Roy. Gard. Calcutta, 1893, vol. iv., pp. 1–169, tt. 1–220.)

Reports of the Botanical Survey of India for the years 1892–93, 1893–94, 1894–95, 1895–96, 1896–97. Simla, 1893–97.

On some Indian species of *Canarium*. (Journ. As. Soc. Bengal, 1894. vol. lxii., pp. 184–188, tt. 10–13.)

Descriptions of two new species of *Cinchona*. (Sc. Mem. Med. Off. Army of India, 1894, part 8, pp. 59–61, tt. 1–2.)

A guide to the Royal Botanic Garden, Calcutta. Calcutta, 1895, iv. and 32 pp.

A brief memoir of William Roxburgh, author of the "Flora Indica." (Ann. Roy. Bot. Gard. Calcutta, 1895, vol. v., pp. 1–9, Frontisp.)

On a new species of *Renanthera*. (By G. King and D. Prain.) (Journ. As. Soc. Bengal, 1896, vol. lxiv., p. 328.)

On some new Orchids from Sikkim. (By G. King and R. Pantling.) (Journ. As. Soc. Bengal, 1896, vol. lxiv., pp. 329–344.)

Notes on the Indian species of *Vitis*, Linn. (Journ As. Soc. Bengal, 1896, vol. lxv., pp. 108–114.)

Descriptions of some new Indian trees. (Journ. As. Soc. Bengal, 1896, vol. lxv., pp. 114–117.)

A second series of new Orchids from Sikkim. (By G. King and R. Pantling.) (Journ. As. Soc. Bengal, 1896, vol. lxv., pp. 118–134.)

On *Croftia*, a new Indo-Chinese genus of *Scitamineae*. (By G. King and and D. Prain.) (Journ. As. Soc. Bengal, 1896, vol. lxv., pp. 297–299, t. 9.)

A century of new and rare Indian plants. (By G. King and P. Brühl.) (Ann. Roy. Bot. Gard. Calcutta, 1896, vol. v., pp. 71–170, tt. 102–200.)

Some new Indo-Malayan Orchids. (By G. King and R. Pantling.) (Journ. As. Soc. Bengal, 1897, vol. lxvi., pp. 578–605.)

The Orchids of the Sikkim-Himalaya. (By G. King and R. Pantling.) (Ann. Roy. Bot. Gard. Calcutta, 1898, vol. viii., pp. 1–342, tt. 1–448.)

Descriptions of some new plants from the North-Eastern frontiers of India. (By G. King and D. Prain.) (Journ. As. Soc. Bengal, 1898, vol. lxvii., pp. 284–305.)

The early history of Indian Botany. (Journ. Bot., 1899, vol. xxxvii., pp. 454–463.)

A sketch of the history of Indian Botany. (Address to the Botanical Section of the British Association for the Advancement of Science, Dover. 1899.)

George Dickie [in Aberdeen University Appreciations.] Aberdeen (Aurora Borealis Academica, 1899, pp. 326–335.)

A second century of new and rare Indian Plants. (By G. King, J. F. Duthie, and D. Prain.) (Ann. Roy. Bot. Gard. Calcutta, 1901, vol. ix., pp. 1–80. tt. 1–93.)

The Flora of the Presidency of Bombay, by T. Cooke, pt. 1; a review. (Journ. Bot. 1901, vol. xxxix., pp. 392–393.)

Flora Simlensis, by Sir H. Collett; a review. (Gard. Chron., 1903, 3rd ser., vol. xxxiii., pp. 117–118.)

Presentations to Museums.—Franco-British Exhibition. In addition to the products received from this Exhibition, recorded in *Kew Bulletin*, 1908, pp. 457, 458, the following have since been received.—New South Wales section. Plants of *Xanthorrhoea arborea*, *X. hastilis*, *Triodia irritans*, *Hakea acicularia*, *H. gibbosa*, also a flowering spike of Giant-Lily (*Doryanthes excelsa*), &c. These were presented by Mr. J. H. Maiden, F.L.S., Director, Botanic Gardens, Sydney. From the Indian Section per Mr. B. J. Rose, a collection of raw vegetable products including samples of Cotton, Jute, Sisal Hemp, also 9 logs of Andaman timbers and a series of models illustrating Agriculture in India.

The following other miscellaneous specimens have also been recently presented to the Museums :—

Messrs. Howard Bros. Chesham. Specimens to illustrate the manufacture of butter prints and wooden spoons.

Mrs. Eustace Smith, Lyndhurst. Water-colour drawing of a Giant Tasmanian Lily (*Doryanthes excelsa*) which flowered in a garden in Algeria six or seven years ago.

Mr. R. S. Lynch, Cambridge. Earthen pot as used in the collection of Turpentine from *Pinus Pinaster* in the forests of the Gironde.

Mr. F. W. Jackson, District Commissioner, Northern Territories, Gold Coast. Specimens to illustrate the manufacture of fibre and cordage from *Hibiscus cannabinus*. These were exhibited at the Kumasi Agricultural Show and were presented at the request of Mr. A. E. Evans of the Botanical and Agricultural Dept., Gold Coast.

Mr. A. E. Bernays, Kew. Bowl of tobacco pipe formed of the fruit of a species of *Eucalyptus*, Queensland.

Mr. T. Wilkinson, Rochdale. Board of figured Pitch Pine.

Mr. A. E. Evans, Botanical and Agricultural Dept., Gold Coast. Samples of rubber from *Funtumia elastica*, coagulated with the juice of a vine known as "Diecha," Coomassie.

Mrs. Duff, North Walsham. Branch of *Eucalyptus coccifera* from a tree 10 years old.

Mr. S. T. Dunn, F.L.S., Superintendent, Botanical and Forestry Dept., Hong Kong. Sandals and clogs made partially of the sheaths of *Phyllostachys Quilloi*, also specimens of the sheaths, from Japan, and ropes and cables of various dimensions, made of Bamboo, generally used on Chinese junks.

Mr. H. W. Hilliard, Ealing. Portion of stem of a species of *Populus* bitten out by beavers, Minnedosa, Manitoba.

Dr. Treub, Director of the Dept. of Agriculture, Buitenzorg, Java. A collection of photographs of Gutta and of Rubber plantations, Tjipetir, Java.

Assistant Director, Kew. Plant of *Nototriche turritella* and photograph of the plant in its native habitat, from the slopes of El Misti, near Arequipa, Peru, alt. 13000–15000 ft., collected by the donor March, 1903.

J. M. H.

Erythrina ovalifolia.—This tree, which had not hitherto been recorded further west than Ceylon, is represented in a small collection of herbarium specimens from Pemba Island (near Zanzibar), which is 40° further to the west, and separated by a stretch of ocean over 2,500 miles wide. It had, however, previously been collected on the Comoro Islands by Hildebrandt and Humblot, but the specimens had remained unidentified.

When the habitat of *E. ovalifolia* and its mode of seed dispersal are taken into consideration, the great extension of the known area of distribution offers no serious difficulties. It is a prickly tree, 30–50 ft. high, with wide-spreading branches. In Pemba and the Comoro Islands it occurs in swamps on the sea-shore; in Ceylon, according to Trimen,* it is rather common in low country, by the banks of rivers and streams; in Burma, according to Kurz,* it is common in the tidal forests and tidal savannahs, and also in the beach jungles; and in Samoa, and the Fiji and Tonga Islands it appears to be confined to the littoral region. In New Caledonia, however, it has been collected on the mountains, according to Zahlbruckner; and in Java, where it occurs almost exclusively on the banks of streams, pools and morasses, it is found at various elevations up to 2,300 ft., although most frequent in the low plains.

An interesting question, which at once suggests itself, is whether *E. ovalifolia* was originally a littoral plant which has spread inland, or an inland plant which has spread to the littoral region. Guppy, who has studied similar cases in the Pacific, is of opinion that the purely littoral stage was the first, but the facts as to *E. ovalifolia* suggest an inland origin for that species. If it commenced as a littoral, why should it have penetrated inland only in Java and New Caledonia? Assuming it to have originated inland, however, and to have spread to the sea-shore, the small inland area and the very much greater range of littoral distribution are what might be expected.

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* The references to *E. ovalifolia* are given at the end of the note.

There is abundant evidence in support of the dispersal of species of *Erythrina* by ocean currents, and in the case of *E. indica* and *E. ovalifolia* the evidence is particularly striking. In 1883 the islands of the Krakatau group, situated in the Straits of Sunda, were the scene of the most violent volcanic explosion of historic times, which completely destroyed the original vegetation, burying it beneath a thick pall of glowing ashes. Treub, who visited them three years later, found seedlings of nine species of phanerogams growing on the drift zone of the beach, among which was an *Erythrina*. All had presumably grown from seeds or fruits cast up by the waves. Penzig, who investigated the vegetation in 1897, found both *Erythrina indica* and *E. ovalifolia* among the plants which had established themselves on the beach.

Guppy,* who has investigated the question of plant distribution in the Pacific, divides the seeds and fruits which are distributed by ocean currents into three groups (1) where the floating power is derived from unoccupied space in the cavity of the seed or fruit, no part of the seed or fruit possessing independent floating power; (2) where the floating power is due mainly or entirely to buoyant kernels; (3) where it is due to the presence of air-bearing tissue in the seed-coats or wall of the fruit. The seeds of *Erythrina indica* and *E. ovalifolia* belong to the second group.

Full references and a summary of the distribution of *E. ovalifolia* may be found useful.

Erythrina ovalifolia, Roxb. Fl. Ind. vol. iii., 1832, p. 254; Wight, Ic. t. 247; Benth. in. Mig. Pl. Jungh. p. 237; Mig. Fl. Ned. Ind. vol. i. p. 207; Seem. Fl. Viti. p. 60; Baker in Fl. Brit. Ind. vol. ii. p. 189; Kurz, For. Fl. vol. i. pp. xvi. 367; Zahlbruckner in Ann. Hofmus. Wien, vol. iii. p. 277; Trimen, Fl. Ceylon, vol. ii. p. 64; Schimper, Indo-mal. Strandfl. pp. 120, 165; Boerl. in Teysmannia, 1892, p. 535; Koord. et Valet. in Meded.'s Lands Plantent. No. xiv. p. 70; Hemsl. in Journ. Linn. Soc. Bot. vol. xxx. p. 174; King, Materials, vol. iii. p. 72; Perkins, Frag. Fl. Philipp. vol. i. p. 85; Merrill in Philipp. Gov. Lab. Publ. No. xxvii. p. 39; Ernst, Fl. Krakatau, p. 41.

E. fusca, Lour. Fl. Cochinch. 1790, p. 427, fide Koord. et Valet, l. c.

E. picta, Blanco, Fl. Filip. ed. 1, 1837, p. 565, non Linn.

E. caffra, Blanco, Fl. Filip. ed. 2, 1845, p. 394, non Thunb.

Duchassaingea ovalifolia, Walp. in Linnaea, vol. xxiii. 1850, p. 742; Hassk. Hort. Bogor, p. 192.

Gelala aquatica, Rumph. Amb. vol. ii. t. 78.

India. Bengal, Sylhet, Assam, Burma, Malay Peninsula, Ceylon. Malaya. Siam, Java, Sumatra, Philippines. Polynesia. Samoa, Fiji and Tonga Islands, New Caledonia. Tropical Africa. Pemba Island. Mascarene Islands. Comoro Islands.

E. fusca, Lour. takes priority over *E. ovalifolia* if Koorders and Valeton are correct in making them synonymous.

T. A. S.

* Observations of a Naturalist in the Pacific, vol. ii., Plant Dispersal.

Seeds of Cycnoches chlorochilon.—In March, 1896, a seed capsule of *Cycnoches chlorochilon*, Klotzsch, was obtained from Messrs. Hugh Low and Co. for preservation. It was fully developed, and had been cut from a recently imported plant. A drawing was made, after which the capsule was cut longitudinally for convenience of drying, and the number of seeds proved so enormous that they were submitted to Dr. Scott, then Honorary Keeper of the Jodrell Laboratory with a view of ascertaining their approximate number. The report was as follows :—

"I find the number of seeds in the capsule of *Cycnoches chlorochilon* to be about $3\frac{3}{4}$ millions.

"The result was arrived at as follows :

Total weight of seeds in paper	18·60 grammes.
Total weight of paper alone	4·75 „
Total weight of seeds...	13·85 „
Weight of two coverslips with about 300 seeds	0·2275 „
Weight of two coverslips alone	0·2264 „
Weight of about 300 seeds	0·0011 „

"Thus we get a proportion sum :

$$\cdot0011 : 13\cdot85 : : 300 : x.$$

$$x. = \frac{13\cdot85 \times 300}{\cdot0011} = \frac{4155}{\cdot0011} = \frac{41550000}{11} = 3{,}770{,}000 \text{ approximately.}$$

"This is itself only a rough approximation and as you said some seeds had been lost in opening the capsule you might take the total number at about four millions. In other words the progeny of this single flower, if all the seeds came up, would be about equal to the population of London.

"The weight of each seed works out to the very minute figure of ·0000036 grammes. About 300,000 seeds to the gramme (very roughly)".

This is much in excess of figures previously recorded for orchid capsules. Darwin estimated the number of seeds in a capsule of *Orchis maculata* as about 6,200, and Mr. J. Scott, of the Royal Botanic Garden, Edinburgh, calculated the number in a capsule of *Acropera* as 371,250, while F. Mueller informed Darwin that he found about 1,758,440 seeds in the capsule of a *Maxillaria* in South Brazil. The seeds weighed $42\frac{1}{2}$ grains, and he estimated the number by arranging half a grain of seed in a narrow line, and then counting a measured length. He adds that the same plant sometimes produces half a dozen capsules. It may be added that the capsule of *Cycnoches chlorochilon* under notice measured six inches long by two inches broad. The sexes are separate and the female flowers so far as known are solitary, but the males are borne several together in a raceme.

R. A. R.